# THE DENTAL PRACTITIONER

## AND DENTAL RECORD

*Including the official reports of the British Society of Periodontology, the British Society for the Study of Orthodontics, the European Orthodontic Society, the Glasgow Odontological Society, the Liverpool and District Odontological Society, the North Staffordshire Society of Dental Surgeons, the Odonto-chirurgical Society of Scotland, and the Dental and Medical Society for the Study of Hypnosis*



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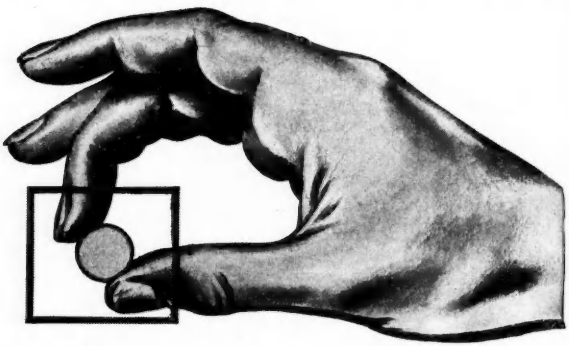

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# THE DENTAL PRACTITIONER AND DENTAL RECORD

Vol. VIII, No. 7 March, 1958

*EDITORIAL*

## TEMPORARY DRESSINGS

THE problems associated with temporary dressings in cavity preparation are not always appreciated to their fullest extent. A slap-happy method of applying zinc-oxide-eugenol or gutta-percha to all and sundry conditions may lead to failure of the final restoration. The three main objects of a dressing are to protect the exposed dentine and the pulp, to maintain the position of the tooth in relation to the other teeth, and to protect the soft tissue. In small cavities where retention is not a problem, no real difficulty arises unless the dressing is required to remain in place for some months. In these cases the difficulty is easily overcome by first applying zinc-oxide-eugenol to the floor of the cavity and then filling the remainder with cement. This is in effect a temporary filling, which in any case is always much more satisfactory, as zinc-oxide-eugenol tends to shrink and disintegrate over a period of time. The real problems arise in complicated cavities where there is little or no retention for a dressing. Difficult inlays, crowns, and bridges can present problems which tax all our ingenuity. Unless a correct dressing is applied in these cases, the tooth may over-erupt or drift mesially or distally. This may happen in a relatively short space of time, and ten days may make the difference between a bridge fitting correctly and being of no use at all. Probably the most difficult tooth to dress is the canine when it has been prepared for a three-quarter crown. There is nothing worse than making what appears to be a perfect inlay and then finding that one contact point is too tight, the other too loose, and that the bite is far too high. On inspection, the opposing tooth is found to touch the dentine of the prepared tooth and the whole operation has to be done again. The temporary coverage of a tooth during complicated restorative procedures has to be thought out before the treatment commences. It cannot be left until the last minute just before the patient is due to leave the surgery and the next is ready in the waiting-room. It is desirable not only in these cases, but in many other cases, to take some quick impressions of the mouth and prepare study models. Many different types of temporary dressings may be designed and some actually made on these models, either in metal or acrylic. Considerable time may be saved in the surgery if some sort of preformed temporary restoration is at hand for immediate insertion with zinc-oxide. At first sight this may seem to be laborious and a financial loss, as it requires the services of a laboratory. However, it must be balanced against a possible extra visit from the patient to replace a dressing, as well as the possible waste of time through endless adjustments to a good piece of work at the fitting stage. In addition, the effect of bad dressings on the soft tissue must not be forgotten. This is particularly important in anterior restorations where æsthetics is a prime factor. All in all, bad dressings can lead to bad dentistry, while careful, good dressings can save time and ensure good dentistry. It is not worth spoiling the ship for a ha'porth of tar.

# PROVISIONAL COVERAGE AND SPLINTING PROCEDURES IN CROWN AND BRIDGE CERAMICS AND REHABILITATION*

By **W. CAMPBELL HUDSON**, D.D.S., *New York*

A ROUTINE procedure for providing temporary coverage of abutment teeth and replacement of missing teeth is necessary in modern crown and bridge and occluso-rehabilitation techniques. The patient requires, and is entitled to, provisional crowns, bridges, and splints immediately after the preparation of abutments has been completed. If cemented with a sedative, temporary cement, this type of replacement minimizes irritation to the teeth and gingival tissues and permits the patient to pursue his normal business and social activities without embarrassment or distress. The self-curing acrylics have made this important service possible and, at the same time, helped to solve many of the perplexing problems of the past.

Extrusion, drifting, tilting, and tortion of those abutments which have been taken out of occlusion and removed from contact need no longer be problems. The provisional splint, constructed according to individual requirements, can serve to maintain the teeth which have been prepared for full coverage in normal position. The techniques about to be described fulfil these requirements, while the effect on the gingival tissues is such that the patient is much more comfortable during this period and the health of the tissues is promoted. Chronic bleeding and gingival exudation around the abutment teeth is uncommon. Instead, the tissues are firm, with the gingival margins being pressed gently outward. The gingival crevice is shaped like a widened V as a result of the contouring of the splint in the subgingival area.

In this condition the cleansing, medication, varnishing, and maintenance of a dry field are more easily attained for the cementation of the final restoration. Function is restored and occlusal balance established. The vertical opening may be increased with the splint. It can be studied and refined before construction of the final restorations. Periodontal, endodontic, or surgical treatment may be instituted during the wearing of a splint. It is often desirable to refine or modify the abutment preparations before individual banded impressions are taken. Gingival recession following surgery often makes extension necessary. Further reduction of line angles, providing room for recessed rest seats or precision attachments, and reduction of labial and buccal surfaces are refinements which may be necessary before the final restorations are processed. The splint remains undamaged and, when recemented, provides the same protection as before. If a radical change must be made in the length of a preparation, this length can be added to the splint in acrylic with the brush technique, first cleaning all temporary cement and traces of essential oils from the part.

Æsthetically, since the splint is the result of a hasty one-colour pressing, it may be far from ideal; but, considering all factors, it fulfils the requirements of utility and æsthetics quite well.

The average patient has one or more missing teeth in either or both arches. Plans are made to include the temporary replacements as part of the splint or a removable partial denture. This splint provides the operator with a guide in completing the final restorations. Notations are made of desirable changes in the temporary coverage to be taken into account, mechanically and æsthetically, in the fabrication of the final prosthetic appliance. The provisional replacements provide the operator with an advance preview of the completed work.

There are many splinting techniques, each having its own merits. Since saving chair time is important, a technique in which most

* A paper delivered to the American Dental Society of Europe, July 11, 1955.

of the work is done in the laboratory is highly desirable. After the abutments have been prepared, a specially treated alginate impression is readied for use in the pressing of the splint. This impression is made from a prepared study model and timed to the abutment preparation. The technique is efficient and sufficiently flexible to handle most situations, including single or multiple porcelain jacket crown temporary covers.

Full-mouth study models are mounted on an adjustable articulator in correct centric relation and adjusted to lateral and protrusive movements. Mounting may be done through the use of the face bow or in any manner the operator prefers. Correct mounting is extremely important. The impressions for the study models should be carefully taken in alginate or hydrocolloid. The mouth should be clean and free of all debris, so that sharp detail can be acquired. A proper size tray is selected, filled with the impression mix and positioned over the teeth after the occlusal, buccal, lingual, labial, and interproximal surfaces of the teeth have been thoroughly wiped with the material in order to prevent voids and trapped air. The impression tray is held steady and maintained in position for the time suggested in the manufacturer's directions, the water–powder ratio and temperature specifications being closely followed. With any alginate or hydrocolloid, it is a good rule to allow it to set or cool a minute longer rather than to remove it too soon. Distortion may occur, particularly in the molar region, if it has not fully set. When poured immediately, the models show fine detail and are ready for mounting.

The model is removed from the articulator to facilitate easier manipulation and dampened. With a sharp, straight-sided instrument, keeping parallel to the long axis of the tooth, the gingival crevice is deepened about one and a half millimetres, the depth varying with the periodontal condition and the anticipated preparation of the abutment. Experience and judgement are the determining factors in estimating the depth. The trough is extended about the labial or buccal and lingual surfaces and into the interproximal areas of the adjacent teeth. When there are missing adjacent teeth, the trough is carried from the buccal around to the lingual surface.

The deepened gingival crevice is bevelled so that it looks like a widened V in cross section. The model is replaced on the articulator so that any corrections in the occlusion and anatomy can be made in wax. Broken cusps, contacts, and cavities may be filled with inlay wax and carved to contour and occlusion. At this point any erosions are restored and the gingival half of the teeth to be splinted is overcontoured, the wax being tapered to a thin film in the depth of the crevice. Missing teeth should be replaced on the model using miscellaneous teeth or carving them in wax, re-establishing occlusion.

A few minutes utilized in perfecting the anatomy and wax additions is time well spent. The model is thoroughly soaked in water, soaped well, and the excess soap is rinsed off. Using the same tray as in taking the impression for the study model, an impression of the model is taken, the operator being careful to wipe the soft impression material well into the crevices at all points before seating the filled tray on to the model. When it has set, the impression is removed from the model and the excess is trimmed away. The impression is ready for use in constructing the splint. Time is important at this point, since the impression should be available as soon as the abutments have been prepared.

Examination of the impression in the area to be splinted demonstrates a thickened gingival sulcus, wider and deeper than normally. There are also heavier contours on the teeth. The full mouth impression facilitates precise seating of the impression during the succeeding stage.

A thin mix of acrylic is wiped into the areas of the impression to be splinted, using a slight excess to ensure proper compression when the tray is pressed to position in the mouth. Care should be exercised that no air is trapped in the tips of the teeth impressions. The use of a lanolin gel offers protection to tissue and prevents adherence to other acrylic restorations. A firm constant pressure is maintained

on the tray to allow the flash to spread out evenly over the adjacent tissues. After about two minutes, the pressure is released and the tray is maintained in position by the patient or chair assistant. The excess acrylic left in the mixing jar is held in the hand to be used as a setting guide. When maximum heat begins to be liberated from this mass, the impression is quickly removed. The splint usually remains in position on the abutment teeth. Body heat hastens the set of the acrylic mix when held in the hand. The bulk of cool impression material retards setting in the mouth. Therefore, when the maximum heat of polymerization is felt in the control mix held in the hand, it indicates the proper time for the removal of the impression. The splint is sprayed with cold water, tested for hardness, and removed at the proper time. Tissue burns may occur from latent heat liberated in setting, which indicates the need for removal at the proper time.

The splint is teased off the abutments, showing a flash of uniform thickness, extending from the gingival crevice onto the gingiva. This thin excess is removed with scissors. The finishing and refinement is completed, following which the splint is polished and cemented, using a sedative temporary cement.

## ANALYSIS

The treatment of the gingival crevice and slight over contouring of the teeth on the study model, which is subsequently transferred to the impression, avoids one of the problems which is inherent in the regular impression technique, in which there is a compressive force exerted on the gingival margin, pressing the tissue tightly against the tooth. Little or no soft acrylic is capable of entering the gingival crevice. The splint, therefore, is short of the gingiva, offering no protection to the gingival margin and lacking in subgingival depth and contour. The edges are also thin, permitting minimal shaping and finishing.

In the corrected impression there is a shoe-horn effect against the gingival margin. This is due to the compressive force of the deepened and heavier gingival wedge in the impression and results in retraction of the gingival tissue. The soft acrylic is able to enter the crevice and provides adequate contour in this area of the splint, thereby allowing for a sufficient bulk of acrylic which can be finished with a smooth continuous margin. This margin promotes the health and tone of the gingival tissues, keeping the patient comfortable. Ignoring this fact can lead to irritated, bleeding, proliferating gingival tissue which complicates the work and may distress the patient. After perfecting the occlusion and anatomy, the splint is polished and inserted. There are many modifications of this technique which depend upon the ingenuity and imagination of the operator.

## MODIFICATION OF TECHNIQUE

Copper bands can be utilized subgingivally, improving marginal adaptation and contour. When a temporary partial denture is to be retained by clasps, this type of splint resists loosening very well. Copper bands are fitted and festooned over the prepared teeth and are shortened to about three millimetres in length. The occlusal or incisal end is snipped in numerous places to assist with acrylic retention. Before replacing them on the prepared teeth, they are painted with a thin coat of opaque acrylic cement for colour control and retention. Acrylic in the proper shade is tamped into the alginate impression in the teeth to be splinted and the impression is seated in the mouth as in the previous technique. After the acrylic has set, the splint is removed, the copper bands being exposed in the subgingival areas. These areas are covered by the brush technique. The occlusion is corrected, the anatomy adjusted, and the splint is polished and cemented. This technique provides almost perfect gingival adaptation, which gives strong resistance to loosening and eliminates the possibility of the cement being washed out. A careful check for overextension of copper bands beneath the gingiva at all points should be made before cementation as a precautionary measure against over-compression of the gingiva. The copper band technique

varies from one case to another, but the added effort provides a better result. The extra time is worth while for the operator and the patient.

When a patient has a removable partial denture with clasps and rests or precision attachments, it is often desirable for him to continue to wear the denture during rehabilitation. Although it may seem a bit involved, there is a technique which is in reality a time-saver over the alternative of making another provisional partial. One abutment is handled at a time to ensure control of the accurate seating of the case.

An alginate impression of the jaw, minus the partial removable denture, is taken, wiping the alginate carefully into the female of the attachment or into any type rest seat in the crown or inlay abutment. The impression is put aside. The crown or inlay is removed with as little distortion as possible, cleaned in acid, and replaced on the preparation and tested for fit with the case.

Deformation often takes place, but bending and reshaping usually make re-adaptation possible. A crown with a rest seat or precision attachment should be scored well on the internal surface for better acrylic attachment, and a generous slot should be cut from the gingival to the occlusal on the contact surface opposite the rest seat or precision attachment. This provides an acrylic bond to the adjacent tooth preparation which may be included in the splint. The slot is omitted if the crown is to be the only abutment.

In the event that an inlay or three-quarter crown forms the rest seat or holds the female of a precision attachment, the cleaned inlay is undercut liberally for better acrylic attachment. As great a surface as possible is preserved to provide an accurate seat in the alginate impression. The impression is dried of any free moisture and the crown or inlay is carefully placed in its seat in the impression.

Acrylic is flowed a little at a time by the brush technique over the inlay and the exposed occlusal surface, building a thin shell until the entire surface of the impression of the abutment tooth is covered. After setting, the hollow shell is removed from the impression, the excess is removed and it is placed in the clasp or on the male attachment. The shell is filled generously with acrylic dough, and the bridge and shell are seated in the mouth over the prepared abutment and tested for occlusion. After setting, it is removed, finished, polished, and cemented with temporary cement. The procedure is repeated for the other abutments.

When other teeth are to be prepared adjacent to such abutments, it may be desirable to attach the splint to those already made. This is easily accomplished with the brush technique. With the finished sections of the splint seated in the mouth, acrylic is brushed a little at a time between the dried sections to form a strong bond. Joining sections in this way preserves the relationship among the abutments and resists loosening of a section, particularly if that section has a clasp, rest, or precision attachment anchored to it.

The shell veneer splint has a wide range of usefulness, but does not seem to me to offer the same advantages as the splint described. In making a splint with the shell method, the original alginate impression, or one taken from the study model, is used to form a shell or multiple shell for those teeth to be splinted. Acrylic is brushed a little at a time into the impression of the teeth to be splinted till a hollow shell is formed. A slight excess of the acrylic is built up at the gingival margin, avoiding overlapping onto the gingival area. This is put aside to be used when the abutments have been prepared. The shell is filled with a mix of acrylic, pressed to position in the mouth, checked against the opposing teeth in centric relation, and allowed to set. After trimming and polishing, it should require little occlusal adjustment.

There are cases in which patients have worn acrylic splints for a year or more with a fair degree of comfort and function. However, when it is desirable to delay the completion of the final restorations or better æsthetics and more precise occlusal relationship are required, it may be advantageous to build splints of gold and acrylic. Better æsthetics are possible because of blended shades. Occlusal

wear is also negligible. Such cases still require allacrylic splinting as an immediate measure.

In preparing a gold and acrylic splint, a full mouth alginate impression is taken of the prepared teeth. The soft impression material is wiped carefully about the dried preparations to obtain fine detail. The poured model is articulated, using accurate wax bites, with the opposing model which is on the articulator. The preservation of centric relation is extremely important. When multiple abutment preparations are in progress, centric relation may soon be lost unless registered at the start. Wax bites should be taken after the preparation of one or two teeth, before molar support is lost. They can be corrected as the other teeth are prepared. These bites, taken in duplicate, are preserved and used in mounting the models in proper centric relation. The gingival crevice can be deepened and bevelled outward with greater ease if the model is removed from the articulator, as in the previous technique. In this instance, however, a little more conservation should be observed, as tooth contours have already been removed and the trough established. Care should be exercised to maintain a uniform trough around the circumference of all preparations.

The model is soaked in water, and all preparations are lubricated prior to waxing the splint. Melted inlay wax is flowed to position over each preparation, and worked off and on until easily removed and until it fills the trough accurately. The wax is built to occlusion, and the carving of the individual teeth is begun. The use of serrated steel separating disks in the interproximal spaces aids in individualizing the waxed teeth. A plaster index of the corrected study model may be used to wax the splint for roughing in the labial and buccal anatomy. Full facial contours and anatomy are built in order to visualize the finished effect better. When occlusion and anatomy are completed, the buccal and labial surfaces are cut out and retentions placed. A heavy sprue is attached to each crown or dummy and the waxing is invested. To secure adequate expansion, the double investment technique is followed, in which a thick mix is used to form a core over the wax pattern. Dry powder is vibrated into the core till no free water rises to the surface. Another mix is used to complete the investment in an asbestos lined ring.

In the case of longer spans, the wax may be divided and cast in two or more sections for later assemblage. Interlocking sections work out very well, particularly when lack of parallelism or other factors make it desirable. The resultant casting is finished and polished after being fitted to the model. Since tight fit in temporary appliances is not necessary or desirable, the contact surfaces of the splint are relieved generously to provide more space for the sedative cement and also to permit easier removal and insertion. In lengthy preparations this relief is particularly important. When removable partials are to be made for provisional use, rests of any type may be cut in crowns to be used as abutments. Acrylic in selected shades is processed in the cut-out faces, and the finished splint is tried in, tested for occlusion and protrusive and lateral excursions and, when satisfactory, cemented with a temporary medium. A separate impression is taken of the splint which is seated in the mouth for the purpose of processing any type of partial in order to complete the full complement of teeth. There is great flexibility in the making of either the all-acrylic or the gold and acrylic types of splints. When extractions are to be done, the preparation of the abutments pre-operatively can provide an immediate replacement. This may salve the patient's pride, protect the operative site, and give comfort and improved æsthetics.

## SUMMARY

Perhaps the most significant advance that has been made in extensive rehabilitation techniques is the provision for temporary coverage and splinting of abutment units and the maintenance of occlusion and function during this period. To-day, the patient need not be a dental cripple while undergoing involved treatment, but may function normally and with comparative comfort. From the

operator's standpoint, the problems of drifting, extruding, depressed or migrating abutments are greatly diminished. The improved health and tone of the gingival tissues provide an ideal foundation on which to build a biologically, as well as mechanically and æsthetically, sound denture.

In the techniques which have been described, provisions have been made for obtaining good coverage beneath the gingiva down to the prepared finishing line. Careful contouring of the area, holding the gingival margin slightly away, provides an ideal field in which to work and promotes the health of the tissues. The corrected impression, with its deepened gingival trough and outward bevel, facilitates the construction of a superior splint as quickly as the abutments have been prepared.

Splints made of acrylic or a combination of gold and acrylic have many advantages in the restorative procedures of crown and bridge and occluso-rehabilitation techniques. Important among them are:—

1. Restores function and occlusion.
2. Acceptable æsthetics.
3. Improved health of gingiva.
4. Avoidance of irritation of sensitive preparations through temporary coverage.
5. Extrusion, drifting, tilting, and torsion of abutments are prevented.
6. Ease of removal.
7. A reference point is provided from which changes in the final restoration may be evaluated.
8. Improved patient co-operation.

## General Anæsthesia for Conservative Dental Procedures

This method of treatment is indicated for very young children, spastic and mentally retarded ones, and for hysterical patients. Few of the children treated suffer any psychological trauma. A non-explosive, non-inflammable anæsthetic agent is necessary and the one chosen is nitrous oxide/oxygen plus trilene.

For very young children induction with $N_2O/O_2$ is continued with $N_2O/O_2$ plus trilene. Older children and adults may be induced with intravenous sodium pentothal. Nasal intubation into the larynx keeps the mouth clear for operative procedures. The pharynx is packed with gauze two or three inches wide and moistened with saline.

The procedures on one side of the mouth are carried through from cavity preparation to the testing of the occlusion on the newly-carved amalgam. The mouth prop is now placed on the treated side of the mouth. Any necessary extractions are performed at the end of the restorative treatment.

Although these types of operations can be carried out in the dental chair, admission to hospital is desirable because the patient is always under trained-nursing supervision and it is more comfortable for the dentist to seat himself at the head of the supine patient on the table.—HEATH, N. (1957), *Aust. dent. J.*, **2**, 75.

## "Clicking Jaw"

In answer to the question:—

A girl of 16 has in the past three months developed a persistent and very audible clicking on the right side of the jaw, which occurs when her mouth is about half open. What treatment is advised and what is the prognosis?

The following reply is given:—

This patient would be well advised not to seek treatment. A clicking jaw can be cured by operative removal of the cartilaginous meniscus of the temporomandibular joint, but an operation of this severity is hardly indicated for so trivial a symptom as a click. I gather that there is no limitation of movement of the jaw.

Such patients are sometimes helped by manipulation under an anæsthetic, but if there is no limitation of movement of the joint then manipulation would be only a form of suggestion therapy. The patient should be reassured, told that there is nothing seriously wrong with the joint, and that many people have clicking jaws. It is very likely that the click will disappear in time.—*Brit. med. J.*, **2**, 838.

# OBSERVATIONS ON TWO ANÆSTHETIC AGENTS, XYLODASE PASTE AND XYLOTOX EXTRA PASTE

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and Squadron Leader **P. J. R. NICHOLS**, M.A., B.M., B.Ch., D.Phys.Med.

SINCE the introduction of Xylocaine, several new surface anæsthetic agents containing a Xylocaine basis have become available to dentistry. The first was 5 per cent Xylocaine ointment and its application has been reviewed by Graffner (1949) and Gruber (1952). More recently Xylodase paste and Xylotox Extra paste have appeared and their composition is shown below.

This paper reports the findings of a clinical investigation in which an estimation was made into the duration of surface anæsthesia obtainable from (1) Xylodase paste, and (2) Xylotox Extra paste. In addition, the duration of anæsthesia produced by the two pastes was compared with the anæsthesia obtained from Xylocaine injections of known volume and concentration. By this means an estimation was made of the possible quantities of the surface anæsthetic agents entering the tissues.

**Material.—**

1. 1 per cent solution of Xylocaine hydrochloride.
2. 2 per cent solution of Xylocaine hydrochloride.
3. Xylodase paste:—

| | |
|---|---|
| Xylocaine hydrochloride | 5 per cent |
| Hyaluronidase | 0·015 per cent |
| Water-miscible base to | 100 per cent |

4. Xylotox Extra paste:—

| | |
|---|---|
| Xylocaine hydrochloride | 5 per cent |
| Amethocaine-hydrochloride | 2 per cent |
| Base to | 100 per cent |

## EXPERIMENTAL PROCEDURES

Four subjects were employed, aged between 18 and 24 years. Each of the four patients attended a total of eight visits and on each occasion was subjected to one surface anæsthetic estimation and one Xylocaine estimation.

All the experiments were carried out on the labial mucosa of the lower lip, opposite the lower canine, using both sides of the mouth.

The experiments were divided into two main groups:—

1. Surface anæsthetic duration estimations.
2. Xylocaine estimations.

**Surface Anæsthetic Duration Estimations.**—In these estimations a similar quantity of Xylodase paste or Xylotox Extra paste was applied to a similar area of the oral mucosa for an equal period of time; the duration of anæsthesia was recorded.

For this purpose a surface anæsthetic applicator of duraluminum was designed. This apparatus (*Fig.* 1) consisted of an inner cup (c) which acted as a paste reservoir. This was surrounded by an outer cup (o) which functioned as a vacuum chamber when the apparatus was applied to the oral mucosa and was connected by a rubber tube (t) to a saliva ejector attachment of a dental unit.

A sufficient quantity of paste was just allowed to fill the applicator (c). The apparatus was placed in contact with the oral mucosa. After 60 seconds the applicator was removed and a distinct circular mark remained on the mucosa where the apparatus had rested. This area was tested for anæsthesia immediately following removal of the applicator and thereafter at 15-sec. intervals, the time being recorded by a stop-watch. Throughout the experiments the same sharp "pin-pointed" dental probe was used to test for anæsthesia. Duration of anæsthesia was recorded to the nearest minute.

**Xylocaine (Assay) Estimations.**—In these estimations a constant volume of Xylocaine solution of varying concentration was injected into the labial mucosa and the duration of anæsthesia recorded.

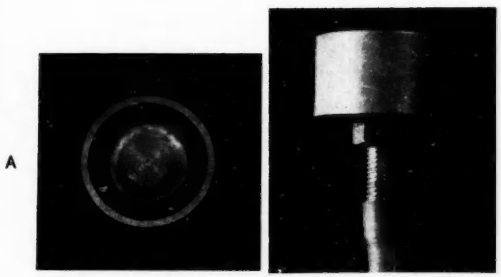
Preliminary tests were carried out using varying volumes of 0·1 per cent, 1·0 per cent, and 2 per cent solutions of Xylocaine. By using a finely graduated "tuberculin" intradermal syringe it was found that 0·1 ml. of a 1·0 per cent or 2·0 per cent Xylocaine solution produced anæsthesia of the same order of duration as that experienced in some

preliminary surface anæsthetic estimations. Finally, it was decided not to use the 0·1 per cent Xylocaine solution as a 0·1-ml. injection produced anæsthesia of only 2–3 minutes.

Thus, in these estimations a 0·1-ml. volume of either a 1·0 per cent or 2·0 per cent Xylocaine solution was injected just under the surface of the labial mucosa, producing a small bleb. This area was now outlined with an indelible pencil. Following removal of the needle, the presence of anæsthesia was examined by using the same "pin-pointed" dental probe. This test was repeated at 15-sec. intervals. Duration of anæsthesia was expressed to the nearest minute.

## RESULTS

The duration of the surface anæsthesia obtained from Xylodase paste and Xylotox Extra paste is seen to be similar (*Table I*), with an average of approximately 10 min.



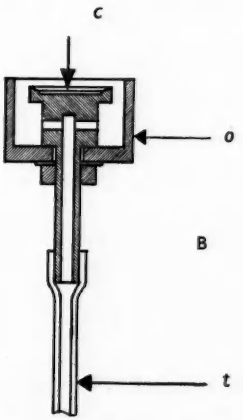




*Fig.* 1.—A, Photographs of the duraluminum surface anæsthetic applicator. B, Photograph from a sectional diagram of the applicator. c acts as a reservoir for the anæsthetic paste under test; o functions as a vacuum chamber when the apparatus is applied to the oral mucosa and connected by a rubber tube (t) to the saliva ejector attachment of a dental unit. (× 1.)

In the statistical examination of the results, the treatment means for the four different substances were estimated. This allowed Xylodase paste to be compared with Xylotox Extra paste and with known 1 per cent and 2 per cent Xylocaine injections. This comparison indicated that the effect of Xylodase paste is not significantly different from the effect of Xylotox Extra paste nor from that of an injection of a 2 per cent solution of Xylocaine, but the effect of both pastes is significantly different from that of an injection of a 1 per cent solution of Xylocaine.

By interpolation on a logarithmic scale the 95 per cent confidence limits for Xylodase paste and Xylotox Extra paste in terms of Xylocaine injections are:—

The duration of surface anæsthesia from Xylodase paste is equivalent to a 0·1-ml. injection of a 1·42–2·11 per cent solution of Xylocaine.

The duration of surface anæsthesia from Xylotox Extra paste is equivalent to a 0·1-ml. injection of a 1·45–2·17 per cent solution of Xylocaine.

Since estimates of the true treatment values are unlikely in this case to be normally distributed we have avoided the use of the familiar standard error. The limits given here give some idea of the range of values in which the true values may be expected to lie. There is, in fact, a 95 per cent chance that the limits given straddle the true value.

## DISCUSSION

In the present tests both pastes rapidly produced surface anæsthesia within approximately 1 minute. This confirms the findings of Trotter (1954), who, following an extensive clinical trial of Xylodase paste, noted similar findings. However, no figures were given for the duration of anæsthesia.

Owing to the different composition of the two pastes under investigation, especially the

hyaluronidase content of Xylodase paste, it was considered likely that some differences would be found in the resulting surface anæsthesia. The tissue-splitting enzyme hyaluronidase acts specifically on the cementing substances of the connective tissues. Lobby and Kirby (1949) found that block and infiltration injections of procaine hyaluronidase produced more rapid, deeper, and more diffuse areas of anæsthesia than pure procaine hydrochloride. At the same time the resulting anæsthesia was of shorter duration. These authors also found that the spreading effect was less impressive when the procaine hyaluronidase injections were made intradermally instead of into the connective tissues.

However, under the experimental conditions employed in this investigation no such differences were detected. Thus both pastes produced anæsthesia at the same time, of similar duration, and apparently anæsthetized areas of similar size. Therefore it may be that the oral epidermal surface acts as a barrier, or partial barrier, to the action of hyaluronidase. In addition, if hyaluronidase does pass through the epidermal layer of the oral mucosa, it would appear to do so in such small quantities as to have a negligible effect on any associated surface anæsthesia.

*Table I.*—Showing the Duration of Anæsthesia obtained following the Application of Xylodase Paste and Xylocaine Extra Paste and the Injection of 1 per cent and 2 per cent Solutions of Xylocaine Hydrochloride to the Labial Mucosa of the Lower Lip

| Subject | Side | Xylodase Paste | | Xylotox Extra Paste | | 1 per cent Xylocaine Injections | | 2 per cent Xylocaine Injections | |
|---|---|---|---|---|---|---|---|---|---|
| | | A | B | A | B | A | B | A | B |
| 1. | R. | 11 | 9 | 8 | 11 | 7 | 9 | 11 | 13 |
| | L. | 9 | 10 | 9 | 10 | 7 | 8 | 10 | 12 |
| 2. | R. | 10 | 10 | 15 | 9 | 7 | 8 | 9 | 11 |
| | L. | 10 | 12 | 11 | 10 | 8 | 8 | 9 | 12 |
| 3. | R. | 12 | 11 | 10 | 11 | 9 | 8 | 13 | 11 |
| | L. | 12 | 11 | 14 | 9 | 9 | 8 | 12 | 11 |
| 4. | R. | 9 | 9 | 10 | 10 | 10 | 7 | 9 | 10 |
| | L. | 9 | 10 | 12 | 10 | 7 | 9 | 12 | 11 |
| Mean duration of anæsthesia from 16 estimations | | 10 min. | | 10 min. | | 8 min. | | 11 min. | |

Duration is expressed in minutes; A, First estimation; B, Second estimation.

## SUMMARY

Xylodase paste and Xylotox Extra paste, when applied to the oral mucosa under standardized conditions, produced surface anæsthesia of similar duration, lasting approximately 10 minutes.

When compared with Xylocaine injections of known volume and concentration, it was found that both pastes produced an anæsthetic effect similar to that obtained from a 0·1-ml. injection of a 1·42–2·17 per cent solution of Xylocaine hydrochloride.

**Acknowledgements.**—We are most grateful to Dr. N. T. J. Bailey, Reader in the Design and Analysis of Scientific Experiment, University of Oxford, for preparing the statistical

report included in this article and for much helpful advice. Also to Mr. Yap, Dental Clinic, University of Malaya, for the photographs.

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# THE ROLE OF RETAINED UPPER SECOND DECIDUOUS MOLARS IN THE CAUSATION OF POST-NORMAL OCCLUSION

By C. C. KNOWLES, B.D.S., D.D.O.

IN discussing the aetiology of post-normal occlusion occurring in patients in whom the underlying jaw relationships are correct, there are several possible factors to be considered. Amongst these may be included the premature loss of upper deciduous molars, a sucking habit, or a short, functionless upper lip associated with the lower lip pushing up behind the upper incisors during swallowing. As the so-called "post-normal" occlusion in these cases results in fact from a forward movement of the upper teeth, it may be more correct to describe the condition as a pre-normal occlusion of the upper teeth. It has been observed that the type of malocclusion just described may also be initiated by the over-retention of the upper second deciduous molars after the beginning of the eruption of the canines.

*Fig.* 1.—Retained upper second deciduous molar. First premolars cusp to cusp. Increased overjet.

*Fig.* 2.—Retained upper second deciduous molar. First premolar held in front of lower opponent.

Broadbent (1941) has pointed out the important part played by the erupting upper canines in the positioning of the first premolars in the following words: "Until the last of the deciduous teeth are shed, the first permanent molars that have up to this time occluded end to end, now join the canines and premolars and adjust themselves to the normal adult articulation. The canines play a great role in completing this articulation, as they wedge their way between the laterals and the first premolars, forcing the first premolars distally to compensate for the difference in the mesio-distal diameter between the deciduous and the permanent teeth."

In most cases there is sufficient room for the first premolar to erupt between the upper deciduous canine and the second deciduous molar and for it to occlude just on the distal side of the cuspal point of its lower opponent. The final interdigitation of the upper and lower first premolars will then be completed

as described above. Occasionally, when the upper arch is a little crowded or when the upper second deciduous molar is a little oversize, the first premolar will be held forward and occlude cusp to cusp or even in front of its lower opponent (*Figs.* 1 and 2). Should it become locked in this position, then the erupting upper canine will be unable to gain space by moving it distally. If it becomes apparent that such a condition is likely to occur, then the extraction of the upper second deciduous molar and the retraction of the upper first premolar can often save more extensive treatment later on. The difference in size between the upper second premolar and its deciduous predecessor is usually sufficient to allow the first premolar to be retracted and still to leave room for its eruption.

If orthodontic intervention does not take place then a more severe malocclusion will develop in the following way. With the eventual shedding of the upper second deciduous molar, the second premolar will move forwards into contact with the first premolar and come into occlusion in front of its lower opponent. The space thus created in front of the upper first permanent molar will be filled by the forward movement of that tooth, in this way completing the picture of a "post-normal" occlusion.

The effect on the incisor segment will depend largely upon the incisor occlusion already present. When this is good, the upper canine will be forced labially out of the arch as would have occurred in the case illustrated by *Fig.* 2. The overjet already present in *Fig.* 1 would tend to be further increased as the malocclusion developed fully and the canine attempted to fit in between the lateral incisor and the forwardly placed first premolar.

*Fig.* 3.—Spontaneous correction of premolar occlusion after extraction of $\underline{e}|$ in case shown in *Fig.* 2. Upper canine now in place.

*Fig.* 4.—Correction of case shown in *Fig.* 1 after extraction of $\underline{e}|\underline{e}$ and wearing Andresen plate.

The models in *Fig.* 3 show an unexpected spontaneous correction of the malocclusion in *Fig.* 2 following the extraction of the deciduous molar. Although an appliance had been constructed to retract the first premolar, by the time the patient returned to have it fitted, correction had already occurred. The interval between the extraction of the deciduous molar and the self-correction was approximately three weeks. The case illustrated by *Figs.* 1 and 4 was treated with an Andresen plate, following the extraction of the second deciduous molars. The premolar occlusion was correctly established very quickly, but the illustration (*Fig.* 4) shows the condition after some months of treatment.

## SUMMARY

Two cases are presented to illustrate how the timely intervention by the orthodontist can prevent the development of a severe malocclusion from a relatively simple original condition, namely, the over-retention of the upper second deciduous molars.

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# RADIATION HAZARDS IN ODONTO-STOMATOLOGY*

By **SYDNEY BLACKMAN**, L.R.C.P., M.R.C.S., D.M.R.E.
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THE interest and importance of radiation hazards in odonto-stomatology are fully realized by the dental profession. It is a problem confronting all who use ionizing radiation, and much research has been carried out during the past decade, especially in Europe and the United States of America, in all aspects of the biological effects of these radiations.

The daily increase in the utilization of X rays in the surgery by the general dental practitioner emphasizes the danger of excessive radiation, and the advent of atomic research and nuclear explosions has reawakened the professions and laity in their interest in radiation activity. But the biological effects of atomic radiations and their dangers are nothing new.

We have been aware of the existence of radiation hazards almost from the very year of the discovery of the X rays, just over sixty-two years ago. Two or three years later, the presence of residual ionization was revealed in an electroscope.

In 1897, such biological effects as dermatitis and epilation had been observed and it was known then that the introduction of an aluminium filter reduced the liability to X-ray burns. Some far-seeing pioneer workers soon began to stress the importance of adequate protective measures and called for accurate assessment of dosage. It is recorded that in 1898 the British Roentgen Society appointed a committee to investigate X-ray hazards.

At the turn of the new century, much interest was taken in secondary rays produced by the passage of a primary X-ray beam through matter, and a number of papers were published about this phenomenon at this time. However, it was the increase in the use of X-rays during the first World War which brought matters to a head.

In 1921 the British X-ray Radium Protection Committee was formed and its recommendations were adopted all over the world. The First International Radiological Congress was convened in 1925. Many discussions took place on protective measures against dangers of radiation, and three years later a tolerance dose of 0·2 r per working day was considered to be appropriate.

Gradually a new field for research was established in radiobiology and collective action was undertaken by radiologists, morphologists, biochemists, and physiologists. By the end of the second World War the mechanism of the biological action of ionizing radiations had become clearer with the realization of nuclear energy.

The magnitude of ionizing radiation has increased considerably in recent years, and we are to-day asking ourselves, "Are we fully aware of these radiation hazards?" Our problem is concerned with the determination of the dose of radiation that can be tolerated without apparent danger by the personnel to sources of radiation, and the valuation of the extent to which the level of natural radio-activity to which mankind is exposed can be exceeded without danger.

When we have studied and agreed upon these radiation hazards, it is our duty to disseminate our knowledge and experience to our fellow workers. At the same time we should be prepared to recommend the adoption of well-tried measures of protection to those persons exposed to ionizing radiations.

The sources of radiation are twofold: (*a*) natural; (*b*) artificial.

The natural sources of ionizing radiation emanate from terrestrial radio-activity and cosmic rays, from internal absorption from

* Read before the Western Division of the Public Dental Officers' Group and the West of England Branch of the Society of Medical Officers of Health, Bristol, January 18, 1958.

air, food, and water, and from the radio-active isotopes present in the body itself. This 'background' radiation, although varying in its geographical location, probably has not changed in its intensity since the beginning of creation.

The background dose is small compared with doses known to cause immediate somatic changes, carcinogenic action, and long-term genetic upheavals. Nevertheless, no assessment of radiation hazard can be undertaken without considering the natural as well as the artificial sources of radiation.

This has led to the recognition of a "radiation level", and from such limit the maximum permissible dose for each X-ray worker has been calculated to be 0·3 r per week, measured in air, and for the non X-ray worker, 200 r to his whole body (excepting the reproductive organs) during his lifetime.

By far the greatest source of artificial radiation arises from X-ray machines, and this use of radiation in hospital and private practice is steadily increasing as larger and cheaper sources become available as by-products of atomic energy processes, the isotopes.

Irradiation dangers resolve themselves to primary and secondary radiations risk, and the latter need further consideration. When the issuing X-ray beam from the tube head strikes any substance, part of the beam may be absorbed and the rest is scattered or dispersed, altered in direction, but almost unaltered in quality. Again, every substance receiving direct or scattered radiation itself gives out X rays from all depths, and the quantity increases in amount with the thickness traversed by the X rays.

The hazards of scattered radiation are similar to those of primary rays. They have the same effect on the body as any other ionizing radiation, are cumulative and sufficiently penetrating to reach the bone-marrow, and can likewise be responsible for mutations, blood changes, and tumour growths.

Scattered radiation arises everywhere, from the tissue through which it is passing, from the bones of the patient, from sandbags, from surrounding items of apparatus, from cassettes, and from the table, if the patient is resting on or against it. The scattered rays are distributed in all directions, although not uniformly.

More of these rays are to be found in the forward and backward directions of the original beam rather than at right angles to it. The greater the penetrating power of the primary beam, i.e., the kilovoltage, the greater is the increase not only in the magnitude but also in the penetrating power of the scatter.

The actual dangers of irradiation from primary and secondary rays may not be apparent until it is too late to counteract them. X-ray radiation is cumulative in effect and additive, and is always of a degenerative nature. It is not only the single large concentrated dose of X rays which produces the harmful results. Numerous small repeated doses have a deleterious action upon human tissues.

Our particular interest lies in the dental field. We have to consider to what extent dental radiography adds to the accumulation of ionizing radiation in an individual during his lifetime, the effect of such radiation upon the actual area X rayed, upon more remote areas, and upon the reproductive organs.

Further, is the patient receiving the utmost protection against radiation exposure? Is the technician fully aware of the attendant hazards and is he taking all precautions to eliminate them? Are all the techniques and exposures calibrated in roentgen units, and are the examinations necessary and properly controlled?

Reviewing the many X-ray techniques which are carried out on a dental patient, it must be admitted that the oral region is submitted to more radiographic examinations and with more frequency than any other equivalent area of the body. In addition to routine all-round radiography for peri-apical or interproximal disease, repetitive examinations are undertaken in the control of treatment in the root-filling of teeth, in checking erupting teeth, and assessing post-operative and traumatic progress. The periodic cephalometric examination of orthodontic patients,

temporomandibular radiography in connexion with prosthetic reconstruction, and extra-oral pictures for mandibular and maxillary lesions present a formidable list of exposures for a confined region with mounting concern for the accumulation of irradiation.

Careful measurement of most of the accepted dental X-ray techniques have been undertaken at many centres, under conditions of the greatest protective measures, and the skin dose is sufficiently small and provides a definite margin of safety. But unless precautions are taken, the amount of radiation may rise to disconcerting levels.

Atomic radiation can cause harm to mankind by:—

1. Production of injuries apparent during man's lifetime.
2. Shortening the life-span.
3. Genetic harm which may not appear for generations.

These submissions are based upon observations and experiments with artificial sources of radiation.

**1. Local tissue damage** results from operators who are inexperienced or careless in their techniques, and from those who are not prepared to take the necessary steps to ensure a strict observance of the minimum safety requirements.

In the early days of radiography with the many mishaps and errors in techniques, the hands were the first to show signs of ill-effects of over-exposure. Erythema of the skin was followed by dryness, thickening, and cracking, and in many cases, formation of ulcers, warts, and epitheliomata.

The fingers developed endarteritis of the terminal vessels; the nails became friable with longitudinal fissures, and many broke off at the ends. Dentists' hands are particularly prone to dermatitis because of their exposure to drugs, antiseptics, and moisture.

The skin of the face is less sensitive to X-ray radiation than other areas of the skin, but alopecia was quite a common occurrence. In recent investigations carried out at the Royal Dental Hospital in London it was found that the lens of the eye receives appreciable doses of irradiation, and a survey is in progress as to the associated incidence of detached retinæ and cataract.

In 1953 Burstone claimed that his experimental studies showed that irradiation causes retardation of dentition and facial development. Others have stated that the tooth germs become involved with absence or delay of root formation and development of abnormal dentine in the pulp chamber. One must await further confirmation of such studies as well as more data as to the effects upon the oral mucosa and salivary glands.

The amount of scattered radiation received by the chest during dental radiography calls for further study. In view, however, of the large amount of lymphatic tissue in the region of the neck, which is most sensitive to radiation, it might be contemplated that a shield or bib of lead rubber be worn to protect the patient's neck and apical parts of the lungs from secondary radiation.

**2. The shortening of the life-span** of an individual as a result of excessive radiation must be regarded as a delayed general systemic effect. Much of the work in this field has been experimental on animals and cannot be said to be definitely proven in man. On the other hand, the increased incidence of leukæmia in Hiroshima is submitted as sufficient evidence of shortening a person's life.

The induction of radiation of cancer has been shown to arise in tissues already severely damaged by irradiation or after a long latent period without any previous suspicious signs or symptoms. Cancer of the skin was the earliest form of a radiation-induced malignant tumour, and the other carcinogenic sequel is the change in the thyroid gland of children who have undergone radiotherapeutic treatment of the thymus gland.

Whereas the onset of leukæmia may be ascribed to secondary radiation, the neoplastic changes in the skin and thyroid gland are definitely produced by repeated direct exposures to the X-ray beam, and therefore can be controlled and prevented.

**3. The reproductive organs** suffer damage with smaller doses than the amount needed to produce radiation effects on other parts of the body. Cells showing the most active

metabolism and proliferation are the most readily affected by the X rays.

Our knowledge of genetics is based mainly on indirect evidence, on experimental studies on mice, plants, and fruit. The only direct study is that made on the children of those who were in Japan when the atomic bombs exploded. It would seem unjustifiable to draw inferences concerning man from these remote organisms or from observations limited to the first generation.

Summarizing the work to date on genetic changes following irradiation, the following conclusions seem acceptable:—

*a.* Damage to genes is cumulative and irreparable.

*b.* Changes in a somatic cell are not passed on to progeny.

*c.* Genetic consequences in individuals beyond the age of reproduction are nil.

*d.* Additional radiation, however small, to background radiation causes an increase in the rate of mutation and not new types of change.

*e.* Descendants of parents with mutant genes may be shortlived or sub-virile.

Special studies have found that the gonads receive such small doses during intra-oral radiography that even if twenty complete mouth examinations of 14 exposures each were made of individuals during the first years of their lives, the male gonads would receive 0·3 r and the female gonads 0·05 r.

It is apparent, therefore, that the additional dental radiation is very small indeed and holds no terrors of genetic changes to an individual. However, it must always be remembered that dental radiography may well be only one of the many radiographic examinations which the patient may need in his lifetime. Thus it is important that every care should be taken to reduce the dose to the patient in order that adequate dose may still be available for an emergency or routine examination which may at some future time be necessary to save the patient's life.

## PROTECTION OF THE PATIENT

Generally speaking, the measures adopted to reduce radiation exposure are common both to patient and operator, and any X-ray examination should be limited so as to be compatible with successful diagnostic investigation.

The International recommendations state very definitely that responsibility for radiation precautions is vested in the radiologist.

The protective measures should concentrate upon using only useful X rays, limiting the X-ray intensity upon the skin surface, reducing the exposure time, confining the irradiated area to a minimum, and protecting immediate and remote areas of the body subject to secondary and scattered radiation.

1. The highest proportion of radiographically useful X rays are obtained by employing the highest kV. that gives adequate contrast and by inserting an aluminium filter in the beam to absorb the long wave-length X rays which are most harmful to the skin.

2. The X-ray intensities on the patient's skin and at the film are achieved by using a long-focus-skin distance. In dental radiography, the focal skin distance should not be less than 8 in. or 20 cm.

3. The exposure-time is reduced by using the fastest film compatible with the detail required.

4. The irradiated area should be reduced by inserting a restricting diaphragm or a narrow protective cylinder at the outlet of the tube. The emanating radiation and the volume dose to the patient from both primary and secondary radiation are thus restricted.

5. Protection should be provided for critical tissues. The eyes should be shielded by lead goggles, the lymphatic tissue of the neck by a lead rubber bib, and the gonads by wearing a light lead apron.

In view of the cumulative biological effect of X rays, it may be well to consider the advisability of providing each individual with a national card to carry through life, to chart and record every radiographic exposure with its equivalent "r" units to which he is subjected. With the maximum permissible dose before him and the total radiation so far received by a patient, the operator would be in the position to assess the urgency and scope of any further radiographic examination.

## RADIATION PROTECTION OF THE OPERATORS

The protective measures for the operator should include: (1) Appropriate housing of the apparatus; (2) Cubicalizing of the patient; (3) Qualification of the operator to use the machine; (4) Stability and maintenance of the apparatus; (5) Reduction of the dose to the operator; (6) Techniques employed during radiographic examination; (7) Periodical health check of the operator.

1. One of the outstanding changes in concept has been the elevation of X-ray departments from darkened basements of a hospital to a centralized position in the institution. The department should not be below the ground-floor level, it should be free from damp and contain windows affording good natural lighting and facilities for admitting sunshine and fresh air.

The harmful radon and thoron gas content of air has been measured in most geographical locations and it has been found that wind and rain assist in clearing the atmosphere of radio-activity. Stagnant and dusty air retains these harmful gases and their decay products.

Thorough and efficient ventilation is essential in every X-ray department.

2. Every patient undergoing a dental radiographic examination should be cubicalized and enclosed in a protective cabin of lead glass or lead-lined walls. Where two X-ray units are used in close proximity, it is advisable for a permanent protective screen to separate them. The patient himself, as well as the apparatus, is a serious source of scattered radiation.

3. No operator should be allowed to use an X-ray machine unless he has undergone a full and complete training as a radiographic technician. He should be taught the attendant hazards of correct and incorrect operation, and acquire by examination from a competent body a certificate as evidence of his ability to operate a machine.

4. No machine should be supplied unless it carries a guarantee from the makers of its stable and controlled output in the quality and quantity of X-ray production, and should only be installed under licence, in a room and building certified by a local authority as meeting specified requirements of safety.

The direct beam of X rays is capable of penetrating the walls of a room. If the brick and plaster walls of a room are not less than 6 in. thick and the direct beam is always accurately directed at the patient placed in the centre of the room, adequate protection should then be provided against radiation for other persons living or working in the house.

Every tube-head should carry an inherent filter and every cone a limiting diaphragm.

Oil-immersed transformers with glass windows should be covered for stray radiation from the valves within.

A three-monthly maintenance check should be established and a yearly inspection arranged for radiation leakage from the tube head.

5. The dose to the operator should be reduced by incorporating the suggestions adopted for the protection of the patient. The operator should not stand in the direct beam of radiation coming from the X-ray tube, but take up a position behind a protective screen of lead or outside the cubicle. In any case, he should stand at least 5 ft. away from the X-ray tube and the patient and employ a long time-switch cord.

6. The techniques employed during radiographic examination should be as simple as possible. No film should be held in or outside the mouth by the operator and hand-held fluorescent intra-oral dental screens are extremely dangerous.

7. A periodical health check of the operator must be carried out regularly. The blood-content and count must never be neglected, and the dosage received by all personnel exposed to radiation should be monitored continuously with a pocket ionization chamber or film-made dosimeter. Any decided and progressive drop in either the total leucocyte or total lymphocyte count calls for cessation of work. The operator should limit his work to a 7-hr. day for five days a week and have at least four weeks' vacation each year.

About seven years ago, research workers in Britain, Belgium, and the United States of America claimed that they had discovered

certain chemical protective substances which could act as prophylactic measures against radiation. The experiments so far are not yet conclusive, but it is encouraging to feel that there may be available in the future some alternative protective methods to physical screening and shielding.

Basically it was found that the chemical compounds possessed the ability to increase the resistance of the animal suffering from the more acute reactions of atomic radiation. The substances, Cysteine and Becaptan, must be administered before irradiation.

The foregoing exhortations are submitted in order to convert a once dangerous profession into a safe one. No mere half-measures must be adopted. It must never be forgotten that the effects of accumulated radiation received by an individual by primary or secondary irradiation are not entirely eliminated or dissipated just by withdrawing oneself from the field of operation on vacation.

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## An Air-turbine Dental Handpiece with Manual Speed Control up to 50,000 r.p.m.

The traditional electric dental engine with cord drive has two main disadvantages—low peripheral speed of the cutting bur and objectionable vibration effects. The usual bur speeds are between 4000 and 6000 r.p.m., for which the cutting efficiency is low. The work of Peyton has shown that a steel bur at 20,000 r.p.m. removes four times as much enamel as one at 5000 r.p.m. Diamond stones and tungsten carbide burs reach their peak efficiency at even higher speeds which are not obtainable with cord drive engines. Vibrations are of frequencies ranging from 100 to 200 cycles per second for speeds of 4000–6000 r.p.m. These frequencies are the objectionable ones for the patient. At higher speeds the frequencies increase and produce a less unpleasant sensation. Furthermore, the amplitude of each vibration drops.

Heat production can be a problem. It is a function of peripheral speed and pressure of application. Walsh and Symmons are stated to have shown that a diamond bur at 60,000 r.p.m. and 20 g. pressure removed 3–5 times as much sound enamel as at 3000 r.p.m. at 600 g. pressure for the same increase in temperature. Thus the problem is a similar one for normal and high speeds and can be solved by use of an atomized water spray which limits the temperature rise to about 15° F.

The turbine handpiece is described and illustrated. A compressor capable of maintaining a pressure of 35 lb. per sq. in. is required. Air from the compressor passes through a control unit before being taken by flexible tube to the turbine situated at the "slip joint" end of the straight or right-angle handpiece.

A maximum speed of the turbine of 140,000 r.p.m. produces a bur-speed of 50,000 through a reducing gear. This boosts the torque value. Speed is manually controlled by a bow-shaped spring which lies on the housing of the handpiece and actuates a valve.

This high-speed method has been used by the author in Stockholm for two years and has evoked only favourable comments from his patients.—NORLEN, I. (1957), *Acta Odont. Scand.*, **15**, 199.

# PRACTICAL PERIODONTICS*

By S. CRIPPS, B.A., D.D.S., L.D.S.

THE aim of this paper is to discuss the several reasons for the profession's world-wide failure to master that enigma known as periodontal disease. With the exception of a very small minority, the profession is completely at sea. This is not provocation, but a studied statement of fact.

As I see it, the basic problem is twofold. The fact that periodontology is very much in its infancy is not due to an inadequacy of clinical research nor to a shortage of ideas or equipment. Although I agree with the critics who complain of the poverty of pure laboratory research in periodontology, quite candidly I fail to see how additional research at this stage, short of a sensational discovery of some substance that would dramatically change the collagen chemistry of the individual, would benefit the existing situation where the rank-and-file participation in proven routine periodontal procedures is so conspicuous by its absence.

What is missing is a philosophy of treatment. Even those who are fascinated by and absorbed in this work tend to be attracted by a galaxy of methods and techniques. By concentrating on one or two facets, we lose sight of the rest of the pathological pattern.

Two main considerations prevail in these conditions—the constitutional or the systemic and the local. The systemic factor despite intensive research remains a baffling and elusive question-mark. We must recognize the obvious fact that some individuals' tissues respond unfavourably to irritation of local origin. Beyond achieving some amelioration by changing poor nutritional habits and augmenting deficient diets with massive vitamin therapy, very little more can be added to the constitutional side of the picture.

However, the local irritants are the tangibles which we as dentists should be able to treat, and in so doing prolong the life of the natural teeth. The early recognition and thorough elimination of these local irritants and the safeguarding of our operative results are the only means we possess at the present moment.

Let us go back to the scaler and concentrate on perfecting a thorough and methodical technique. Initially, this step will automatically limit our efforts to the less-advanced conditions. As proficiency and judgement progress with time and experience, more and more difficult cases can be undertaken. Our line for the present moment must be the ruthless writing-off of patients whose conditions have gone too far and lavish our precious hours on the early and incipient cases. In short, prevention should sound the keynote of all our periodontal endeavours. Not only must we be able to diagnose the very beginnings of this insidious process but we must once and for all dissociate the word pyorrhœa from that sinister adjective in our vocabulary, incurable. Notwithstanding the gaps in our knowledge of the systemic role in this disease, remarkable strides have been made on the local side. So much so, that we can now view our cases with a greater confidence and optimism than ever before.

If I may digress for a moment, I would like to tell you something about a man who was one of the pioneers in this work many years ago. His name was Prescott Mowry, and he was Dean at McGill University at the time of his premature death in 1955. Forty years ago, after spending some time with Stillman, James, and that indestructible J. P. McCall, he returned to his native town, sharpened up a few instruments, and went to work. He read widely, acquired knowledge, and began to use his eyes to differentiate the abnormal at its earliest stages from the normal; to note the various changes in size, form, colour, and consistency of the soft tissues; to recognize the slightly enlarged papilla; the different shades of redness many degrees removed from the pink of normalcy; the tendency to spontaneous bleeding on the lightest touch; detachment of

* Read at the meeting of the British Society of Periodontology at the Eastman Dental Hospital on Jan. 13, 1958.

the marginal gingivæ from the tooth surface producing early pocketing, etc.

These were all attended to with speed, dispatch, and great enthusiasm. While instruments were scaling and tartar was flying, dear Mowry was carrying on a very intensive campaign of propaganda: what the condition was and why it was there; what the patient had not been doing, and what he was to do in the future.

When he fell ill and he asked his patients to see me at their regular prophylactic recalls, I saw the finest post-treatment results of many years' standing that I had ever seen. How I wished that many of my colleagues could have partaken of this feast and shared these revelations! Of course, he had a peerless touch with a scaler and he possessed a born insight for detecting fine occlusal interferences without the aid of the modern articulator. At a time when the term "curettage" had not yet been coined for periodontal usage, he had actually incorporated this operation in his routine scaling where detachment and pocketing had occurred. Although he was very flexible and he never hesitated to utilize any technique to achieve his result, his mainstay was the scaler. To cap all this, he had a forceful personality that immediately stimulated interest and confidence in his patient. He had no time for perfunctory treatment. Each visit, irrespective of duration, had to leave its mark. Many of his patients had first consulted Dr. Mowry as long ago as twenty-five to thirty years, distraught because their dentists had thrown up their hands and had nothing more to offer than to advise waiting for the inevitable day of doom. When I saw them, not only had they retained most of their teeth but after all those years the condition of the periodontal tissues and the home care were beyond praise. Incidentally, all this work had been carried out in the midst of a large and busy general practice.

The purpose of recounting this anecdote is to dispel the bogy of the hopelessness of periodontal disease, not only from the minds of the public but more vitally from those of the dental profession itself. What Mowry and others have achieved can be repeated by sharing their philosophy and ideals.

Having selected our cases, we can now turn to treatment. Scaling is not a simple operation that can be mastered overnight. A trained delicate sense of touch must be developed that can differentiate calculus from tooth and can make it possible to handle the inflamed soft tissues gently with minimum trauma. To ensure success, this operation demands all the concentration and finesse employed in the most difficult and complex of conservative procedures. I feel certain that the present inability to wield a scaler quickly and efficiently is simply due to a lack of effort and experience. Thorough scaling implies a complete coverage of all the tooth surfaces followed by a rapid exploration of the entire tooth contour with a sharp probe to detect any specks that may have been missed. At the same time, the over-anxious enthusiast must be cautioned against using excessive pressure with these cutting instruments which can strip the cementum and gouge the dentine in one foul stroke.

Supragingival calculus is clay-like in consistency, obvious to view, and easy to remove. Deep in the pocket, however, the calculus is hard, flint-like, and tenaciously adherent to the tooth surface, forming what appears to be an organic union. The proximal aspects of the roots of the posteriors present a slight indentation in the long axis of the tooth and often deposits lodged in this area give the root a deceptive contour and convey the impression that no calculus is present. Many of our failures are attributable to this oversight.

A useful tip given to me by the late Dr. Mowry was to pack a pellet of cotton soaked in iodine or mercresin under fair pressure between the gum and the tooth and leave it there for a few minutes while one carries on with the rest of the mouth. When it is removed and the area is dried with a blast of warm air, the task of subgingival scaling is made so much easier.

We now come to that very pertinent question, How much can be achieved in periodontal therapy by scaling only, quite apart from other techniques? The answer is very much more than one expects, particularly in the early conditions. Even in the more advanced and chronic cases, meticulous removal of all the

deposits, planing and smoothing of the root surfaces, and the curetting away of the spongy granulations of the lateral wall of the pocket produce surprising results.

At the beginning, it would be probably advisable to use infiltration and block anæsthesia for deep subgingival scaling and curettage. An anæsthetized field lends greater confidence and spur to get on with the job. As confidence and proficiency increase, more of this work can be performed with only a topical anæsthetic.

An invaluable suggestion which has served me very well for many years is to use pumice and brush at practically every visit during the course of treatment. It only takes a few minutes, but it keeps the mouth clean at times when it is actually difficult for the patient to do so and conditions the tongue to the feel of clean, smooth tooth surfaces. This, as I shall later point out while discussing hygiene, is a keystone of a favourable prognosis.

As one climbs the periodontal ladder, taking on the more advanced conditions, ancillary aids may have to be considered, but even these, for the greater part, are only a means to facilitate scaling and oral hygiene.

Gingival packs made up of zinc oxide, resin, tannic acid powder, and oil of cloves are used as dressings and displacement agents. Their main function is to reduce inflammation and enlargement and make the deeper deposits more accessible to the scaler. Similarly, certain medicaments are extremely useful for their shrinking and cauterizing properties. Forty per cent silver nitrate solution with Churchill's iodine as a reducing agent, a saturated solution of phenol, carefully produced to the base of the pocket and neutralized with alcohol after one to two minutes, and Talbot's iodo-glycerol solution, painted on inflamed and hyperplastic tissues, have both an astringent and healing action. Sixty per cent trichloracetic acid with bicarbonate of soda as a neutralizer is a dangerous drug, but in selected cases of recurring and persistent granulation is an excellent cauterizer. Reduction of the gingival level will invariably disclose a piece of serumnal calculus that has not been removed. Great care must be exercised in the use of all these drugs. Operation areas should be well dried and other parts of the mouth protected with cotton rolls and gauze swabs, and neutralizers should be to hand.

Certain types of periodontal pockets, fibrosed and gross hyperplastic gingiva, abnormal gingival architecture which predisposes to food impaction demand a more drastic form of treatment than that which has already been mentioned. Gingivectomy and gingivoplasty may have to be used in handling these conditions. In all cases, however, preliminary scaling should be done and acute and subacute conditions reduced before undertaking any further steps.

I would like to mention three points in reference to gingivectomy.

1. We must regard gingivectomy as only one of the methods of treating periodontal disorders. True, when indicated and well performed, it does what is required of it superbly, but it must not become the unquestioned antidote for all our periodontal problems.

2. The time factor of treatment, so intimately tied up with economics, may compel us in borderline cases to elect very early on in favour of gingivectomy.

3. When surgery has finally been decided upon, the normal tendency is to be far too cautious in removing enough of the detached tissue. This should be cut down to the very base of the pocket and more for a distance of 1–2 mm. to allow for an acute bevel. The result will be a knife-edge gingival margin.

## PATIENT EDUCATION AND ORAL HYGIENE

Although some of the methods of treatment of periodontal disease are the subject of controversy, there is general agreement that sound oral hygiene is essential in case management. The most gratifying results in the surgery offer no hope of permanency without the intelligent and meticulous co-operation of the patient. The briefing of patients in the regular use of the tooth-brush, the woodstick, and the mouthwash is as important as the treatment itself and should be carried out at the earliest opportunity. This is the moment to launch into a short but intelligible explanation of the patient's condition.

Almost any device is justifiable that could kindle a spark of interest in home care. It may take time, unlimited patience, and practically every trick in the trade to ring a bell, but it must be done. The ways and means of persuasion will differ from patient to patient. With some, a concise, simple explanation will suffice. With others, firm repetition is called for. With the more difficult ones, the velvet glove of diplomacy may have to be discarded for a more masterful approach. In short, to reason, coax, humour, plead, goad, and even bully are some of the tacks that may have to be employed to secure adequate co-operation. The problem of changing a lifetime habit has been completely underestimated. Although the majority of people brush their teeth twice daily, most of them bring very little consciousness to this operation. Whilst thinking of other things, they go through the motions and can then face the brave world with a clean conscience but not necessarily a clean mouth. To permanently change this haphazard routine into a punctilious after-meal exercise demands a great deal of determination, persistence, and discipline from both patient and operator. It is encouraging to know that once a patient has achieved a satisfactory level of hygiene for even a short period of time and has acquired a taste for well-scrubbed and smooth tooth surfaces, a lapse on his part producing a furred condition is so objectionable to his inquiring tongue that he may return to the fold entirely on his own.

One of the weak links in our approach to treatment is the lack of good judgement in case selection from the point of view of patient co-operation. When the prognosis is so dependent on the patient's oral hygiene, it is obviously irrational to invest a great deal of time and labour on a patient who is only mildly interested. The out-and-out duds are no problem whatsoever. Within minutes, you can almost sense their complete detachment and lack of interest in their teeth.

The more hazardous proposition is the patient who would like to retain his teeth but with no strings attached. In their ignorance, a periodontal lesion is likened to an infected appendix. Once it has been successfully removed, any signs of omission or commission cannot result in a relapse of the original conditions. These people, very nice patients in every other way, are neither geared temperamentally nor prepared to conform religiously to a daily routine. It is sheer folly to run the gamut of periodontal treatment in these tempting cases. The picture after six to twelve months of poor hygiene is a very disheartening one. Even the quarterly prophylactic recall cannot cope with the build-up of three months' neglect. An immediate successful result can overshadow the fact that the elimination of the local factors has not exorcised that invisible but omnipresent prowler, susceptibility. Hence the tie-up between long-term prognosis and patient maintenance.

The two most effective weapons in keeping a mouth clean and healthy are the tooth-brush and the woodstick. The brush must be short, narrow, and made of no more than two rows of medium length bristles. Two brushes should be in daily use and they should be changed frequently. The modified Stillman method of brushing away from the gingivæ is efficient and is not too difficult to acquire. I supply the first two brushes to demonstrate their use in the chair with the aid of a large looking-glass. This demonstration may have to be repeated at some later date.

The modern non-detergent diet has increased the adhesive sediment which litters the interdental areas and the necks of the teeth of our patients. Armed with only a toothbrush, the majority of patients fail to maintain a satisfactory standard of hygiene.

The woodstick is therefore an indispensable accessory as a complement to the tooth-brush. The awkward individual can do less damage with the more controllable stick than in an all-out effort with the brush.

Instead of a customary interproximal push-through, my patients are taught to rub the adjacent tooth surfaces, mesially and distally, in contact with the gums but concentrating mainly on the tooth. In addition to this motion, when the point of the soft woodstick breaks off, which occurs frequently, the now flattened edge is worked with fair pressure on the bucco-gingival neck, inciso-gingivally, in much the same way that an orange woodstick

is pushed on one's cuticle. The reason for this change in stick technique is that food debris does not adhere to the gum but to the tooth surface. This method also encourages greater frictional circulation and keratinization of the gingivæ.

Finally, a few words on the mainstay of periodontal treatment, namely an efficient recall system. It serves the purpose of a thorough removal of calculus, a critical examination of treated areas, and an invaluable inspection of the patient's home care. The patient on his first visit has already been advised that one of the conditions of undertaking treatment is compliance with regular recall.

To sum up in a few words, I would like to say that although no single operation constitutes a periodontal summer, thorough scaling will go a long way towards prolonging a susceptible individual's natural teeth. I hope that you will accept some of my strong medicine in the spirit that it has been given. Brewed over a period of years on both sides of the Atlantic, its sole purpose is to stimulate a greater participation in practical periodontics. As it has been estimated that something like 70–80 per cent of the clientele of a general practice require some form of periodontal treatment, it is unmistakably clear that this considerable task can only be satisfactorily handled by the enlightened general practitioner.

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### Clinical and Roentgenographic Studies of Trauma from Occlusion

Ninety-seven male students, between the ages of 20 and 29 years, with complete, or almost complete, natural dentitions were examined, both clinically and roentgenographically. They were divided into 4 groups, 2 being examined by one author, and the other 2 examined by the second author, a remarkable uniformity being found between the different groups of the two examiners.

The purpose of the investigation was to determine:—

1. The percentage of individuals showing one or more movable teeth;
2. The percentage of movable teeth among all teeth examined;
3. The group of teeth most often showing mobility;
4. The frequency of observable roentgenographic signs and the correlation between these and the mobility from occlusion.

It was found that 98 per cent revealed mobility of one or more teeth during occlusal function. Of 1349 maxillary teeth examined there was an average of 14 teeth per person with 6–7 showing mobility.

Posselt's groups revealed 46 per cent and Maunsbach's groups 50 per cent incidence.

Most frequently affected was the maxillary first permanent premolar with an incidence of 72–78 per cent, followed by the canine with an incidence of 66–72 per cent, and the premolar 60–70 per cent. All observations were confined to the maxillary teeth.

Roentgenographs were examined for the widening of the periodontal space, thickening of the lamina dura, hypercementosis, and root resorption.

Of the 649 teeth with mobility from occlusion, only 56 showed roentgenographic signs. Among 80 teeth with roentgenographic signs, 56 showed mobility from occlusion.—Posselt, U., and Maunsbach, O. (1957), *J. Periodont.*, **28**, 192.

### Zinc Oxide Dressing

A method of using zinc oxide as a dressing is described. A small jar is filled with fine asbestos fibres and mixed with eugenol to make a consistency resembling a squeezed-out sponge. This will keep indefinitely. A required amount is placed on a slab and mixed with zinc oxide to a dense putty-like mass. A day's supply may be kept in an air-tight container.

The dressing may be used for lining cavities, retracting gingivæ, packing interproximal tissue, and when used as a temporary filling it will remain intact for months. When used as a gingivectomy pack, small round balls are squeezed into the interproximal spaces from the labial and the lingual with the thumb and finger.—Newling, P. R. (1957), *Aust. dent. J.*, **2**, 241.

# GROWTH AND THE PREDICTION OF ABNORMALITY*

By J. M. TANNER, M.D., D.Sc., D.P.M.

It is a great honour for a research worker in the basic sciences of anatomy and physiology to be asked to give this Northcroft lecture, and accordingly I have spent much time wondering in just what way anything I say can contribute to the advance of orthodontics. I have no practical experience and little theoretical knowledge of orthodontics. My chief concern over the last few years has been with the growth of perfectly normal children, children who present no particular problems either in their dental or in their general physical development. I do not even have any special knowledge of the growth of the face and teeth; there are certainly many of you here who could discuss that subject much more adequately than I.

But it is very typical of orthodontists all the world over that it should be they, and not the pædiatrician or the orthopædist, or the child psychiatrist, who invite a lecturer from the basic growth and development field. For twenty years now our major support from the clinical side has been from orthodontists, both here and in America. Orthodontists, above all other clinicians, have felt the necessity for a thorough knowledge of the normal growth processes as a basis for a decision to interfere or not to interfere with the course of events in a given child. Perhaps one of the reasons for this is that orthodontists deal for the most part with normal extreme variants rather than with distinctly pathological cases. The only medical specialists of whom this is also partly true are (in this country) the ophthalmologists—though their weapons are much less powerful than yours. The great majority of refraction errors arise as normal variations in co-ordination of the growth pattern of lens and anterior chamber, while only a few, comprising most of the very extreme myopes, have a different single, interfering factor as a cause and are hence called truly pathological (Sorsby, Benjamin, Davey, Sheridan, and Tanner, 1957). I imagine much the same may be said of the commoner conditions that you are called upon to treat.

Not all your patients, however, will receive treatment. Many will be left alone with reassurance to the parent that the problem will solve itself as growth of the face proceeds. Such reassurance can only be given on the basis of accurate knowledge of future events, that is of accurate prediction of the growth curves of the child in question. Prediction of future growth becomes a matter of great importance.

Accordingly, I am going to devote the first part of this lecture to discussing the method by which prediction of a given dimension at age 8, say, may be best made from knowledge of the dimension at age 4. I shall then present some practical results recently obtained in my laboratory on the degree to which adult dimensions may be predicted from measurements taken in the first five years of life. Later I shall go on to talk about the more complicated problem of predicting co-ordinated growth, that is, change of *shape*, using more than a single dimension; and lastly, I shall discuss the use and abuse of standards, explicitly of height and weight for age but implicitly of all other body or face dimensions, too.

## THE PREDICTION OF SIZE AT A GIVEN AGE FROM SIZE AT A PREVIOUS AGE

Suppose the orthodontist sees a child, aged 4, and notes that he has relatively broad maxillary and mandibular arches. He wishes to know what will be the state of these arches at age 8, say, and he hazards the clinical opinion that they will probably be relatively broad then, too. His opinion is entirely correct, but it lacks precision; the snag lies in the "probably". Is there no way by which we can reach some more precise statement such

* Being the Eleventh Northcroft Memorial Lecture read at the Meeting of the British Society for the Study of Orthodontics, held on December 16, 1957.

as, for example: "50 per cent of children with arches this broad by 8 years old lie in the top quarter for breadth of all children—30 per cent lie in the second quarter, 20 per cent in the third quarter. Therefore, the chances are good that this boy's arches will remain wider than average, but a one-in-five chance does exist of the arches being less than average."

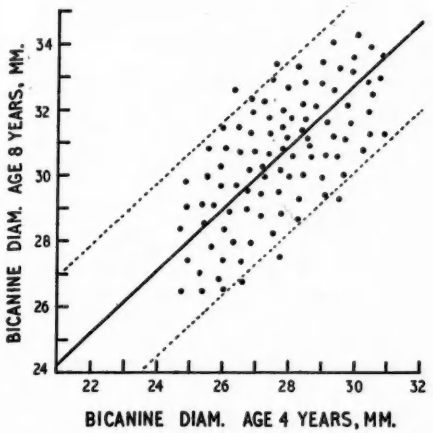


*Fig.* 1.—To show prediction of an anthropometric dimension at later age from same dimension at earlier age. Points plotted are diagrammatic only: regression line from data of Holcomb and Meredith (1956).

Such a statement can be made, and results from the application of a few simple statistical methods. First, we must, of course, have made a study of dental arch widths of children wherein each child was followed from age 4 to age 8. This is what is known as a longitudinal study—one wherein the *same* children are measured in successive years—as opposed to a cross-sectional study, wherein *different* groups of children are measured at ages 4, 5, 6, etc. Longitudinal studies take longer than cross-sectional ones, are more expensive, and demand much patience from the researchers and their administrative supporters, but they are absolutely essential to the understanding of the growth process and for practical purposes, too, as you see from the example I am giving you. Such a study has in fact been made at the University of Iowa by Holcomb and Meredith (1956), who measured 50 boys and 50 girls each year from age 4 to age 8.

The measurement we are considering is the maximum width from the outside surface of one canine to the outside surface of the other. The first step is to plot the bicanine width at 8 years along the Y axis, against the bicanine width at 4 years along the X axis, for each individual. A straight line can then be drawn through these points, but of course the points will not all be along the line but will scatter to either side of it (*Fig.* 1). The line is known as the *regression* line and its equation, $y=a+bx$, or, in this instance,

Bicanine diameter age 8 (mm.)$=4{\cdot}6+0{\cdot}94$ Bicanine diameter age 4 (mm.)
[mandibular, male]

gives the best prediction of age-8 status from age-4 status that can be made on the present data. If we use this equation to predict the 8-year width of a group of boys, however, how often will our results be accurate and how often will they be considerably wide of the mark? The statistic which answers this question is the *correlation coefficient*. (Methods for calculating the regression line and the correlation coefficient, etc., are given in all standard text-books; briefly, they involve using all the original measurements and their squares.) The correlation coefficient measures the degree to which the 4-year and 8-year measurements are associated, the degree of predictability of one from another. The coefficient varies from 0, which indicates that the two measurements in question are totally independent one of another, to 1, which indicates total dependence one on another. In this instance the correlation coefficient is 0·80, a fairly high figure.

Knowing this, and knowing the *standard deviation* (a measure of the scatter around the average) of the measurements at 8 years (1·59 mm.), we can calculate the statistic we are chiefly in need of: the *standard error of estimate*, as

$$1{\cdot}59\sqrt{1-0{\cdot}80^2}=1{\cdot}59\times0{\cdot}6=0{\cdot}96 \text{ mm.}$$

This tells us that when we predict the 8-year measurement from the 4-year one, we shall in approximately two-thirds of all cases be within 0·96 mm. of the actual measurement,

and in 95 per cent of cases be within $2 \times 0{\cdot}96 = 1{\cdot}92$ mm. of the actual measurement. We have thus achieved the extra accuracy that we wanted over the purely inspectional or clinical statement. Perhaps our decision to undertake a certain treatment depends on whether we can reasonably expect this particular arch, now at age 4 years 25 mm. wide, to achieve an 8-year-old width of 30 mm. From our equation we see that our prediction of the most likely 8-year width would be $3{\cdot}9 + 0{\cdot}96 \times 25 = 28{\cdot}0$ mm. There is a 33 per cent chance that this boy's arch might reach 28·96 or roughly 29 mm., and a 2·5 per cent chance it might reach 30 mm. We would then act accordingly.

The precision here is such as is seldom needed in clinical medicine: but in orthodontics it may well be. The moral of this story seems to be: (1) Simple statistical methods are useful tools; (2) Longitudinal studies of healthy children as well as of orthodontic problem children are essential and should be supported.

## THE PREDICTION OF ADULT SIZE FROM SIZE DURING THE FIRST FIVE YEARS

I now want to interject some recent results on the predictability of the *adult* dimensions from dimensions in the first 5 years of life. This work, which was done in collaboration with Professor Lockhart and Dr. McKenzie of Aberdeen, Mr. Healy of Rothamsted Experimental Station, and Mr. Whitehouse of the Harpenden Growth Study, has been given in detail elsewhere (Tanner, Healy, Lockhart, McKenzie, and Whitehouse, 1956), and I shall only call your attention to the most salient points. Some twenty-five years ago Professor Alexander Low of the Department of Anatomy, Marishal College, Aberdeen, took a series of measurements including head length and breadth on a number of children at birth, and on every subsequent birthday up to and including the fifth. We were able to trace and re-measure 65 per cent of these people between 20 and 25 years later, so that we had measurements on a total of 55 men and 65 women at maturity, that is between age 26 and 30. We then calculated the correlation coefficients for each measurement between the values at birth and at adulthood, 1 year and adulthood, 2 years and adulthood, etc. The correlation coefficients are displayed in *Fig.* 2. Looking first at the top line, that is, supine length, we see that the correlation between birth length and adult length is quite small, being about 0·28. (The illustration shows the average of the male and female correlations.) By 1 year old,

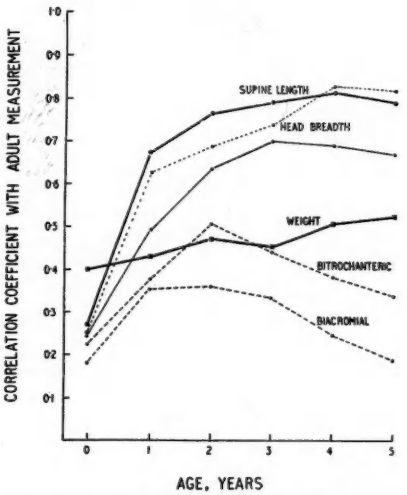


*Fig.* 2.—Correlation of adult anthropometric dimension with same dimension measured at birth and 1, 2, 3, 4, and 5 years. (*From Tanner and others,* (1956), *Arch. Dis. Childh.*, **31**, 372.)

however, the correlation has risen drastically and now approaches 0·7. By 2 years old it is still higher, and there is a further small increase to 3 years old, at which time the correlation is approximately 0·8. Little further increase occurs up to 5 years in this data, and by reference to some other data in the literature, right up to puberty.

You will see that the next line down is that for head breadth, which follows a very similar pattern indeed to that of supine length. Head length is not plotted here, but produces also a similarly shaped curve, though the actual correlations are at most ages slightly below those given for head breadth. The measurement called cubit is of forearm plus hand length, and this also follows the same general

curve. Body-weight, on the other hand, has a slightly larger correlation than most other measurements at birth, but the correlations increase less than for the other measurements, so that prediction of adult weight from weight at 5 years is very much worse than prediction of adult height from height at 5 years.

The main point of interest about these results is the lack of relationship between measurements taken at birth and measurements taken subsequently. Not only are predictions of adult size surprisingly poor if made from measurements at birth, but even prediction of size at one year from size at birth is not very good. It seems that birth represents something of a disturbance in the smooth unfolding of growth. There is other evidence that genetically large fœtuses in small mothers grow particularly slowly during the last intrauterine months, and also are expelled somewhat earlier than large fœtuses growing in large mothers. It takes a little time for these restrained fœtuses to get back on to their presumably genetically determined curves of growth, but it appears that they do get back to it under normal nutritional circumstances by about 6 or 9 months post-partum, and this is very likely the reason why the correlations have risen so sharply by one year.

I doubt if the curves in *Fig.* 2 have any immediate interest for orthodontic practice, but I do not doubt for a minute that similar curves, constructed for various dimensions of the face and head from 1 or 2 years onwards, would be of great interest and of great practical use to many of you. At present we lack such curves entirely.

It is most unfortunate that these Aberdeen measurements cease at 5 years, but some data from other growth studies show that for height at least there is little increase in the correlation with adult value from 5 onwards. It seems that the correlation stays at about 0·8 up to puberty. Then, after a drop at puberty due to time-spreading effect of different individuals having their adolescent spurt at different periods, it rises to near unity as growth ceases (Tanner, 1951).

It seems that the magnitude of the adolescent growth spurt may be to some extent independent of the magnitude of growth previously. This independence may be of more importance in the endeavour to predict adult stature correctly than it is in the prediction of facial changes in relation to orthodontics. An adolescent spurt does, of course, occur in most facial measurements, and is largest in the mandible, which lags behind the rest of the face in its development and is therefore growing fastest, and presumably on that account responding most, at adolescence. Between 12 and 20 years, about 6 per cent of growth remains to be completed in the cranial base, but in boys nearer 25 per cent in the ramus height of the mandible (Tanner, 1955). It is particularly in order to cope with this adolescent spurt independence that Björk (1955) and others have studied facial changes at adolescence, endeavouring to relate them to the general physique of the child in order that we may make better predictions as to what is liable to appear at this time in children of various body builds.

## GROWTH IN PATTERN

The next problem which confronts us, which is at the same time more interesting to the research worker and of more practical value to the clinician, is that of *co-ordinated* growth, or as it is sometimes called, relative growth: growth of one measurement relative to other measurements, growth in *pattern*. The interest in this to the research worker lies in the fact that he does not as yet really understand how to deal with it; we are now right at the edge of the research front.

I do not want to plunge you into the intricacies of a highly technical subject, and in any case, there is no time to do so. But I do want to indicate the lines along which the problems of change in *form* are being tackled.

One of the first approaches was the comparison of the rates of growth of two dimensions by a simple ratio. If $a$ cm./year was the rate of dimension A, and $b$ cm./year the rate of B, then the ratio $a/b$ tells us something about how much faster A is growing than B (cf. mandible and maxilla widths at adolescence, etc.). Julian Huxley's "relative growth" approach is fundamentally this, but in terms of the logs

of the dimensions; his equation $l = bm^k$ reduces to

$$\frac{\text{rate of change of log } l}{\text{rate of change of log } m} = k$$

Though originally Huxley's formulation postulated that $k$ was constant over prolonged periods of time, it is now generally realized that this was an oversimplification and that $k$,

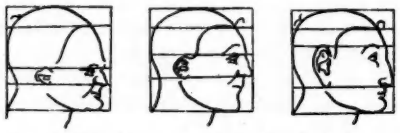

*Fig.* 3.—To show application of method of transformed co-ordinates. (*From D. W. Thompson* (1942), *On Growth and Form*, 2nd edn. Cambridge.)

at least in mammals, describes a continuously varying curve with time, the type of curve depending on what two dimensions are being compared (Tanner, 1951).

This formulation by ratio, whether straight or logarithmic, suffers from the disadvantage that only two dimensions can be handled at one time. I suspect this simple fact is partly responsible for the disputes over exactly what two measurements to compare when analysing lateral skull radiographs, the problem of what dimension to take as a "base-line". A more logical, as well as more comprehensive, approach is not to elevate any one particular measurement to base-line status but to study simultaneously the whole change in form as represented by some dozen or more measurements in serial radiographs. In this way areas where growth rates are large may show up and the distribution of growth gradient fields may become manifest.

D'Arcy Thompson (1942) was the first to suggest this way of analysing form change in his famous book *On Growth and Form*. His method, called the "method of co-ordinate transformation", was purely graphical (*Figs.* 3 and 4). However, it can be made fully analytic, in the algebraical sense, as Richards and Kavanagh (1945), Medawar (1945), and others have shown. The mathematics of this approach are not too simple, but I believe the approach itself is eminently suited to the analysis of changes in the skull and face. I much hope someone with a longitudinal series of skull radiographs in his files will try his hand at it. The ultimate usefulness of the method in analysing shape change in various orthodontic conditions will depend on whether it will convert for us a complicated change of shape into a product of simpler transformations, each term of which represents the action

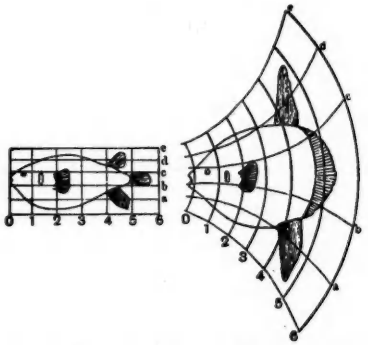

*Fig.* 4.—To show application of method of transformed co-ordinates. (*From D. W. Thompson* (1942), *On Growth and Form*, 2nd edn. Cambridge.)

of a distinct morphogenetic stimulus. (To paraphrase Medawar (1945). This is the same criterion as that invoked in the reification of factors of a factor analysis (Tanner, 1947).) I have hopes that it really would do so.

## THE USE OF STANDARDS

I want now to return for the last portion of this lecture to much simpler considerations, the A, so to speak, of the series of which we have just been considering somewhere around the F. One method of seeing whether a child is growing properly is to plot each of his dimensions in relation to so-called standards for that dimension, that is, in relation to measurements obtained from a group of normal children of the same age. Such a practice, with reference to height and weight, is the standard way of following the growth of the child in baby clinics, school medical services, medical practice, and the home. I shall confine my discussion to height and weight standards, since it will be a discussion of principles which you can translate

readily in their application to growth of facial dimensions.

In the construction of "distance" standards, that is, standards of height or weight achieved at any given age, a cross-sectional study is all that is needed. The most important thing is to obtain an adequate sample of the population

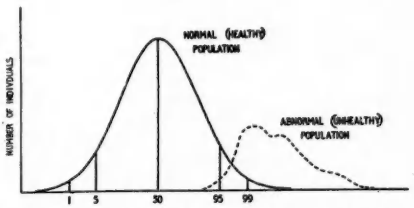


*Fig.* 5.—Possible overlap of healthy and unhealthy populations (hypothetical). (*From Tanner* (1952), *Arch. Dis. Childh.*, **27**, 10.)

of children that the standards are going to apply to, and by adequate I mean not only one sufficiently large in numbers, but one sampling in correct proportion the various social classes, economic strata, geographical sites, and so on. It may astonish you to learn that due to lack of suitable samples it is only very recently that the first reasonably accurate standards for height and weight of British children from birth to maturity have appeared (Tanner, 1958). I do not believe that as yet any suitable data for constructing standards in relation to orthodontic practice are available, and it would seem to me that a survey to obtain them would be a very worthwhile proceeding.

**The Meaning of Abnormal.**—Before these standards are used one has to have some idea of what one means by the term "abnormal". Just exactly how does a standard tell you whether a child is abnormally, let us say, tall, or not? This is a matter about which some confusion tends to exist, and I think it would be as well if I outline one, though not the only, meaning of "abnormal."

Consider a population of healthy children all of the same age. Measure their heights and plot their frequency distribution; you will obtain a Gaussian curve, like that illustrated in *Fig.* 5. Now suppose we have a second group of children with acidophil adenomata of the pituitary, mid-brain tumours, and so forth. This is the abnormal population, and on average its members will be taller than the members of the normal population. Possibly, however, the two populations overlap in their distribution and we get the situation illustrated in the figure. Now suppose we have a child M whose stature lies at the 99th percentile of the normal Gaussian curve. Since the populations overlap in this region it is not possible to say with certainty whether M belongs to one or to the other. All we can state is the probability of his belonging to one or the other, and this probability we can state precisely if we know the distributions of the two populations.

We usually do not know in practice the distribution of the unhealthy population, and so we lay down arbitrary "limits of normality". The essential thing is to recognize that these limits are arbitrary and understand what they imply. If we take the stand that anybody over the 95th percentile shall be called abnormally tall, then we shall pick out of a mixed group perhaps most of the actually abnormally tall children, but only at the expense of including in this category 5 out of every 100 normal children. If we adopt the 99th percentile as the limit, then we shall pick up fewer real abnormals, but we shall only call 1 normal person in every 100 abnormal. The limits of normality that we adopt must obviously depend on the use to which they are going to be put. If the result of being classified as abnormal is an immediate and serious operation, we should have to put the limit at the 99th percentile or beyond to ensure that we operated on very few normals, but if the result of being classified as abnormal is a holiday at the seaside or extra milk in the mornings, then our limits could be much lower, perhaps at the 80th, or its lower equivalent, the 20th, percentile.

There is, of course, as I hinted in my opening remarks, another way in which the word "abnormal" may be used, merely to mean those children who are (to continue for the moment in relation to height) so tall that they offend the æsthetic sense and are socially handicapped by bumping into rafters, doorways, etc. Their

size, however, is their natural size, that is the height they achieve by reason of their genetic potentialities, and in no way implies that they have some pathological process, whether genetic or otherwise, going on inside them. I suspect that this use of the word "abnormal" is that which is most common in orthodontic practice, and also in ophthalmology. I do not know, though most of you here could tell me, whether the average case of a postnormal mandible (Angle II) is dependent on some distinct pathological process; I rather presume not. If I am right in this assumption, then when you strive to detect and correct such a case you are not in the position of the pædiatrician who wonders whether he should explore M's pituitary for a tumour because M is so very tall, but in the position of a pædiatrician who gives massive doses of œstrogen to a girl of 5 ft. 9 in. at age 10 whose predicted adult height will be 6 ft. 2 in. To date, probably only in orthodontics and ophthalmology has any serious effort been made to correct towards æsthetic and practical ideals deviations which carry social and practical awkwardness. Such a practice, though obviously justifiable in these two specialities, would raise some very awkward questions if applied in pædiatrics generally. I do not want to discuss these questions now; all I wish to point out is that we shall not be able to discuss them clearly unless we recognize the two ways in which this word "abnormal" may be used.

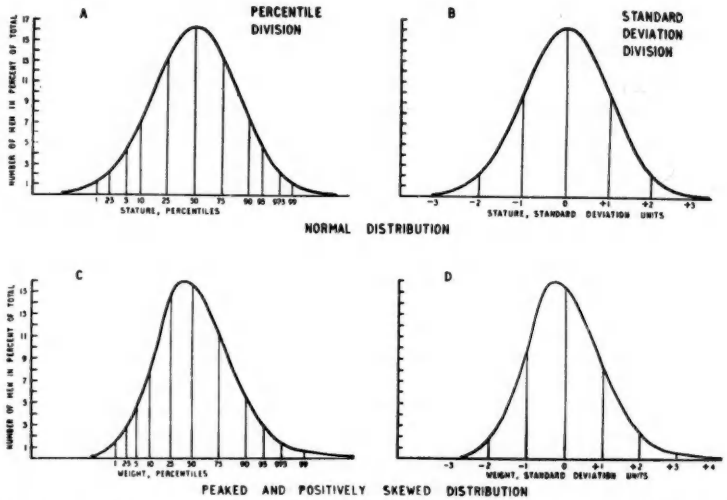


*Fig.* 6.—To illustrate the relation of percentile and standard deviation divisions of: A, B, a population with Gaussian distribution, C, D, a peaked and positively skewed distribution. (*From Tanner* (1952), *Arch. Dis. Childh.*, **27**, 10.)

**Percentiles versus Standard Deviations.**—Our height and weight standards employ either a division into percentiles or else a division into standard deviations (*Fig.* 6). The percentile division speaks for itself; if a child's height places him in the 50th percentile for his group, this means that 50 per cent of the children of the same age are taller and 50 per cent shorter than he. If he is at the 95th percentile, this means that 5 per cent of the children are taller and 95 per cent shorter. It is this position relative to the standardizing group that we always wish to know, but for technical reasons that we need not now go into, the standard charts often give standard deviations instead of percentiles. If, and only if, the distribution of the measurements is Gaussian, as it is with stature but not with weight, then

very direct translations may be made from s.d's into percentiles, +0·67 s.d. corresponding to the 75th percentile, +1·65 s.d. to the 95th percentile, +2 s.d. to the 97·5th percentile, +2·3 s.d. to the 99th percentile, and symmetrically for the minus s.d's. Probably the distributions of most facial measurements are in fact Gaussian, and so this translation would apply directly. But as you can see from charts C and D in *Fig.* 6, in a skewed distribution, such as weight, the percentiles do not correspond in this way to the s.d's. In fact, the s.d. for this sort of distribution is a much less informative statistic than it is for a Gaussian distribution. Thus, standards for weight have either to be presented directly as percentiles or else some transformation of weight has to be given which will convert it into a Gaussian distribution.

**Distance versus Velocity Standards.**—The usual standard chart plots a series of percentiles, for example, for stature against increasing chronological age; the percentiles normally given are 3rd, 10th, 25th, 50th, 75th, 90th, and 97th. The idea is that if a child falls outside the 10th to 90th limits the physician is alerted to the possibility of abnormality, and that if the child further lies outside the 3rd to 97th percentiles he is considered and investigated as abnormal until proven otherwise.

These standards, which are essentially height-achieved ones, are often used for plotting the actual growth of a child from year to year, as in *Fig.* 7 A. This procedure can lead one into difficulties. As a general rule, a child is likely to remain at around the same percentile level throughout his growth, except at adolescence, where if he is an early maturer his spurt will carry him up towards the top percentile and then drop him towards his original level, or if he is a late maturer will drop him down to a low percentile before he recovers to the original level. But since velocity of growth is to a very large extent independent of size achieved, some children will decrease in percentile status regularly throughout the course of their growth, and others will increase, and there is nothing whatever abnormal in this. The converse may also occur, as illustrated in *Fig.* 7 A. A child at the 95th percentile here has an illness which brings him down to the 5th percentile, and later picks up to about the 60th. Conventionally and "cross-sectionally" considered, this child would at no time be under normal stature, yet it is clear that the rate of growth from 4 to 7 years was abnormally low. It is for this reason that I think we should use standards for velocity as well as standards for distance, if we wish to detect abnormality of growth as early as possible. The necessary data

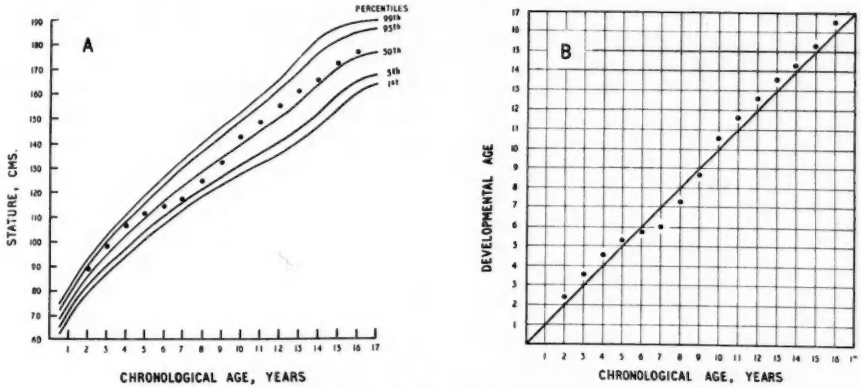


*Fig.* 7.—Growth of hypothetical child with retardation from age 5 to 7 years. Note that neither method A nor B gives test for abnormality of velocity. (*From Tanner* (1952), *Arch. Dis. Childh.*, **27**, 10.)

for velocity standards do not yet exist in this country. I would imagine that, particularly in relation to facial growth where you are concerned with relatively small deviations from average, velocity standards would have advantages over distance ones.

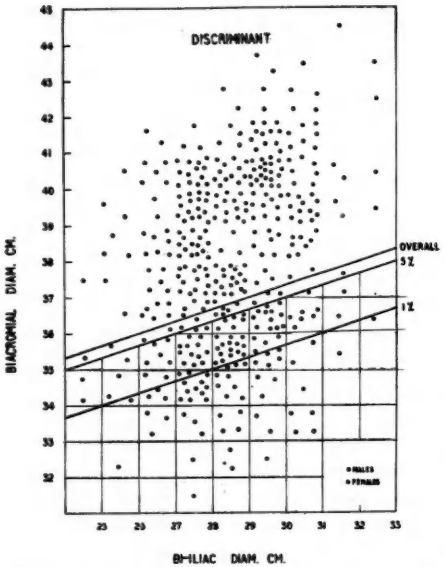


*Fig.* 8.—Construction of a discriminant function. Line "overall" gives best separation of males and females possible by reference to these two measurements; 5 per cent misclassifies 5 per cent of males; 1 per cent misclassifies 1 per cent of males. (*From Tanner* (1952), *Arch. Dis. Childh.*, **27**, 10.)

**Multiple Measurement Standards.**—Lastly, I should at least indicate the next more complicated phase of the use of standards. We have only discussed so far the use of a single measurement for detecting abnormality. It is obvious that really a finer detection could be made by the use of multiple measurements, but we have not discussed how the results of several measurements should be related together to give us an overall diagnosis. But if a child's scores, say on seven measurements, are six 75th percentiles and one 97th percentile, what are we to say? Again, if we had two children of the same age, one at the 95th percentile for height and weight and hip width, and the other at the 95th percentile for height and hip width but the 5th percentile for weight, we would come to radically different opinions about the two. The former is quite simply a large child, the latter a child with a large skeleton and a probably abnormally small amount of muscle or fat, or both. Clearly the relationship between two or more measurements gives us added information about the child, and this information we have so far neglected.

I have no time now to make more than the rather ominous remark that as soon as two measurements instead of one are taken, the situation becomes a good deal more complex than is generally realized. The complexity fundamentally arises out of the fact that the several measurements are not usually independent but correlated one with another. There are mathematical techniques for dealing with the situation and I have endeavoured to outline the simpler of them elsewhere (Tanner, 1952). Let me just mention one. This is the technique of the discriminate function, and let me as an illustration of the method tell you a new way of finding out whether a given person is a man or a woman.

If you are in serious doubt about this matter you may begin your investigation by measuring the bi-acromial and bi-iliac dimensions. Then, consulting *Fig.* 8, plot the shoulder and hip width one against the other in the appropriate place. In this chart the solid circles are males and the open ones females, and you will see that though there is a certain amount of overlap (as in real life), in general the line marked "overall" separates out males into the upper left-hand area and females into the lower right-hand area. The significance of the lines marked 1 per cent and 5 per cent is that if your unknown lies south-east of that 5 per cent line it has a less than 5 per cent chance of being male, and if it lies below the 1 per cent line the chances of it being male are very small.

Now this discriminate function technique can be extended to take in more than two measurements, though of course it is not possible to plot the results simply as in this chart. But one constructs an equation with as many measurements in it as one likes, and

if a patient's score is above a certain figure, then he belongs to one class, and if it is below he belongs to the other. The applications of this technique are fairly obvious.

One could, for example, given a longitudinal series of measurements in normals and in cases of Angle Class II, go back to some early age where differences between the two groups were not obvious and construct the discriminate function which would in fact best separate the two groups at that time. One could then calculate the score of any new patient on this function and get the best possible idea as to whether he would turn into a case of Angle Class II as the years went by. I have, in fact, myself used exactly this technique to distinguish between normal rabbits and rabbits bearing the so-called dwarf gene. Soon after birth it is not possible to tell which are the dwarfs in a given litter just by inspection, but careful measurement of the ears and some other parts, coupled with a little mathematical manipulation, gives you the correct answer a good proportion of the time.

Perhaps something of the same nature might be effected in orthodontic practice when some of these relatively newer, but by no means complicated, statistical methods should come to be applied to carefully collected longitudinal data in this field.


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# BOOK REVIEWS

**CLINICAL ORTHODONTICS. A Guide to the Sectional Method.** By BERA FISCHER, D.D.S. 10 × 7 in. Pp. 478 + x, with 1332 illustrations on 354 figures. 1957. Philadelphia and London: W. B. Saunders. £5 19s.

THIS book is attractively bound in cloth and is printed on art paper. It is divided into three parts, of which the third forms about one-half of the bulk. Part I deals with the history of the development of the sectional methods of treatment. Part II defines the basic principles of the sectional method and includes chapters on the appliances, techniques used, and methods of recording cases. Part III is an atlas of case reports designed to illustrate the principles of this method.

The first three chapters, which are in fact a commentary upon American orthodontics, contain many points which do not apply to orthodontics as practised in Europe. The reader may be a little frustrated by the early chapters, which seek to justify the use of the sectional method, before being introduced to the principle of the method.

Chapter 8, which deals with the construction and use of the appliances, is the best in the book. The techniques of preparing head cap, face bow, and intra-oral appliances are most lucidly explained and beautifully illustrated. The intra-oral appliances, which are modifications of the edgewise arch, will not appeal to everyone in this country. Although Chapter 9 is called "Methods of Diagnosis and Recording", no mention is made of clinical diagnosis, the whole chapter being devoted to methods of preparing oriented plaster casts, photographs, and radiographs.

A large number of cases is illustrated in the atlas of case reports; these are shown before and after treatment and notes are given of the treatment used. All of these cases had postnormal occlusion. One has the impression on reading this chapter that the author has

been faced with a different type of case from those seen commonly in this country.

It was very disappointing to find little mention and no illustration of those muscle forces at which many hints had been made in earlier chapters. Some of the cases would have been more convincing if the condition several years after removal of appliances had been shown.

One is tempted to suggest that the first seven chapters could have been shortened considerably and the scope of the atlas widened to include a more divergent variety of cases. Some of the terminology which is not clearly defined will give rise to confusion in the minds of many readers. However, anxiety about the stability of anchorage in the treatment of Class II cases will increase interest in the case presented for the use of occipital anchorage. By and large, this book, which is essentially one for postgraduate study, dealing with a very limited field of orthodontic treatment, will be of value only to those specializing in this branch of dentistry.

B. C. L.

**CLINICAL PEDODONTICS.** By SIDNEY B. FINN, D.M.D., M.S., Professor of Dentistry (Pedodontics), University of Alabama School of Dentistry; and 7 contributors also from the University of Alabama School of Dentistry. $9\frac{1}{2} \times 6\frac{1}{8}$ in. Pp. 664 + xii, with 275 illustrations. 1957. Philadelphia and London: W. B. Saunders Co. Ltd. 84s.

THIS book has twenty-eight chapters, eleven by Dr. Finn and the others contributed by Drs. Volker, Lanzansky, Parfitt, Cheraskin, Hitchcock, Thomas, and Sharry; all members of the staff of the University of Alabama School of Dentistry. They cover a wide range of subjects including child management, oral diagnosis, roentgenography, facial development, preventive orthodontics, conservation of primary teeth, fractured and misplaced teeth, antimicrobial agents, heredity, oral surgery, periodontal disease in children, and five chapters on the important aspects of dental caries. This book is comprehensive, well-written, and difficult to criticize. Like other books on pedodontics little or no reference is made to orthodontic diagnosis, and although it is appreciated that this is in no sense an orthodontic text-book, some space might have been devoted to the fundamentals of this matter, which is of considerable importance to the pedodontist. For example, in the chapter on preventive orthodontics Dr. Hitchcock writes (p. 261): "placing space maintainers routinely will do less harm than routinely not placing them"; a statement that merits a little discussion and explanation, which is not afforded. Apart from the design of the one-tooth upper denture illustrated on p. 325 this is the only serious criticism that can be made. The book maintains a nice balance between the theory and practice of pedodontics and can be recommended both as a practical manual for the undergraduate and as a reference book or refresher course for the practitioner. The illustrations are good and the whole readable and attractively presented.

J. J.

**TEETHING TROUBLES.** By MATTHEW FINCH. $7\frac{3}{4} \times 5$ in. Pp. 192. London: Dennis Dobson. 10s. 6d.

**THE THIRD SET.** By MATTHEW FINCH. $8 \times 5\frac{1}{4}$ in. Pp. 192. 1957. London: Putnam & Co. Ltd. 12s. 6d.

THESE two books by Matthew Finch follow the line of his first book, *Dentist in the Chair*. They are both of the lightest reading and obviously not to be taken seriously.

*Teething Troubles* is a continuation of his "autobiography", while *The Third Set* is a fictitious story of the dilemma of the dentist who finds himself unwittingly in the news. Whether one agrees with this type of book or not, there is no doubt that Matthew Finch has his moments of humour.

**THE FIGHT FOR FLUORIDATION.** By DONALD R. MCNEIL. $8\frac{1}{4} \times 5\frac{1}{2}$ in. Pp. 240 + x. 1957. New York: Oxford University Press. (London: Oxford University Press.) 30s.

A WELL-WRITTEN and documented account of the growing awareness of the part to be played by fluorides in dental matters. An historical survey is presented from the time when the first inquiring minds wondered about the

stain occurring on the teeth of patients in certain localities, through to the point where the American Public Health Service noted the differing caries incidence associated with the varying fluoride contents of water supplies. Finally the result of the ten-year Kingston-Newburg study, with its confirmation of the benefit to be obtained when the fluoride content of the water is brought to the optimum figure—in this case 1 p.p.m.

The text, though factual, reads easily and much like a novel. The narrative of the uniting of the many and various factions who opposed fluoridation, each with a different motive, a different platform, and often a different axe to grind, but whose common objective was to stop this Public Health measure, is particularly illuminating. However, when all is said and done, the essential common factor of these factions can be seen to be essentially negative.

It is a fascinating presentation of the difficulties that must lie ahead when any new Public Health measure is contemplated or introduced. It shows how necessary it is for the promoters to base their programmes on fact and equally clearly the dangers which can be caused by impatient, enthusiastic supporters. It illustrates how important it is that the uninformed majority must avoid the temptation to be swayed by sentiment, fear, or conservatism. The story in fact places in bold relief what is at stake in this and other Public Health issues—namely, the public's conception of, and trust in, programmes supported by the scientific professions.

A. M. H.

**XYLOCAINE IN ANÆSTHESIA. An Outline of Chemistry, Pharmacology, and Clinical Uses.** $8\frac{1}{2} \times 5\frac{1}{2}$ in. Pp. 63. 1957. Kingston-on-Thames: Astrapharm Ltd. Free on application.

THIS short booklet discusses the general application of xylocaine and its place as a local anæsthetic agent. It covers the special use of xylocaine in general surgery and is a useful addition to background reading on a material that is widely used.

# ABSTRACTS FROM OTHER JOURNALS

### Experimental Production of Periodontitis in Dogs

After a comprehensive review of previous efforts to produce periodontal pockets in experimental animals, a technique used by the author is described.

In this method, gingival tissue was reflected and about 2–3 mm. of marginal bone removed both lingually and buccally with a chisel. Bone was also removed with a bur from between the roots of the teeth and the soft tissue then replaced and held in position with cotton thread sutures between and around the teeth. The animals were fed on a soft diet for two weeks and then subsequently on their normal diet consisting of table scraps.

Radiographs over a period of 12 weeks showed progressive deterioration of the crest of the alveolar process, comparable with those seen in advanced cases of periodontitis in humans. Inflammation of the gingivæ was also observed. There were pockets of up to 5 mm. and digital pressure on the outer aspect of the gingivæ expressed a creamy, purulent-appearing fluid from the pockets.

When observed again 13 months later the mouth was found to exude an extremely foul odour and periodontal breakdown had proceeded further. The involved teeth were mobile and also affected by caries, which eventually completely destroyed the crown, to be followed by exfoliation of the roots.—COLLINGS, C. K. (1957), *J. Periodont.*, **28**, 7.

### Cementum and Dentine Implants in a Dog and a Rhesus Monkey

Large pieces of cementum and dentine shaved from extracted mandibular central incisors of a dog were placed in the extraction wounds at varying depths and a periodontal pack placed over them for 2 days.

A flap was raised in the mandibular left premolar and molar region on the same day in the same dog and bone removed on the mesial

aspect of the first molar to simulate the vertical type of bone loss. Small shavings and one large piece of tooth were placed in this pocket and the flap sutured. The dog was sacrificed after 64 days.

In a Rhesus monkey, cementum and dentine shavings from human teeth were implanted after bone had been removed in two interdental areas, subsequent to the reflection of flaps. In the first case, the implants were made 2 days after the teeth were extracted, the teeth having been placed in penicillin and streptomycin for a day, after which they were still not sterile and were, therefore, autoclaved and the shavings kept in a dry state in a sterile Petri dish for 1 day. At the second site the shavings had been kept sterile and dry for 15 days, prior to implantation. The monkey was sacrificed 28 days after the first implantation.

It was found that osteogenesis occurred in all the implants, but to a much less extent in the surgical periodontal pockets in the dog than in his extraction wounds or in the surgical pockets of the monkey. New bone matrix was present on the surface of both the cementum and dentine implants.

The smaller implants appeared to be more effective in stimulating osteogenetic activity than the large ones, because bone apposition was directly on their surfaces without previous resorption.

In the monkey, cementoid was formed on the root surface and connective tissue fibres were embedded into it, whilst on the other aspect these were embedded in osteoid which had been formed on and around the implants.—SCHAFFER, E. M. (1957), *J. Periodont.*, **28**, 125.

### Pulpotomy by Electro-coagulation

An experiment was carried out to discover whether or not, the adverse factors being eliminated, calcium hydroxide was necessary to the success of treatment of pulpotomy. The adverse factors influencing the treatment are listed as: drugs, dead dentine chips, infection, desiccation, and hæmorrhage. Electro-coagulation was tried as a means of putting the matter to a test, for by its use chemical irritation was avoided, chips of dentine were confined to the cingulum, and infection and hæmorrhage were both controlled.

Using a radio-surgical scalpel four one-second applications to the pulp were made and four to the surrounding dentine. The coagulum was covered with a pad of sterile asbestos fibres soaked in normal saline, and on this was placed sterile tin-foil, zinc-phosphate cement, and then amalgam.

The results of the experiment showed that 12 per cent of the pulps operated on fulfilled the criteria necessary for success; 59 per cent did not meet all the criteria but did not show unmistakable signs of failure; 29 per cent of the teeth had to be extracted.

It was concluded that electro-coagulation did achieve the experimental results expected of it. In answer to the question: "Can a pulp heal without calcium hydroxide?" it is stated that although the percentage of clinical successes is lower than usually claimed for pulpotomy followed by calcium hydroxide, very few of the reported series have been rigorously assessed.—LAWS, A. J. (1957), *N.Z. dent. J.*, **53**, 68.

## ROYAL COMMISSION ON DOCTORS' AND DENTISTS' REMUNERATION

### A Public Statement by the Commission

THE Royal Commission on Doctors' and Dentists' Remuneration held a public hearing on Thursday, March 20, 1958, at 10, Carlton House Terrace, London, S.W.1.

Representatives of the British Dental Association were invited to attend.

## DENTAL RADIOGRAPHY

A TWO-DAY course in dental radiography has been arranged for dental nurses and assistants, to take place on Thursday and Friday, May 15 and 16, 1958, at the Ilford Limited Department of Radiography and Medical Photography, Tavistock House North, Tavistock Square, London W.C.1.

No fee is charged for this course. Application forms will be sent on request.